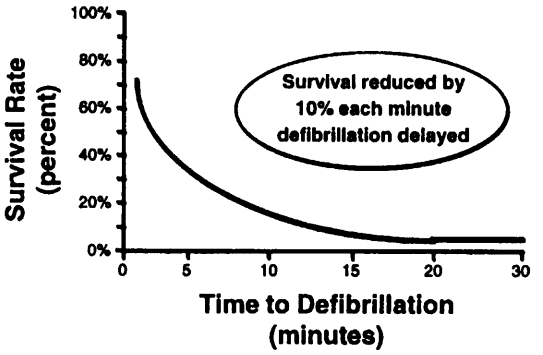
CARDIAC ARREST SURVIVAL DATA

In communities like Fremont where the fire service is the principal provider of EMS first-response, the "chain of survival" standard developed by the American Heart Association often is used to provide guidance for station location (Figure 4.3).

Figure 4.3



The "chain of survival" suggests that the best chance for a positive outcome exists when basic life support (CPR and defibrillation) is made available to the victim of a cardiac arrest within 4 minutes of the event, and that advanced life support (paramedic service) is made available within 8 minutes or less of the event. In 2002, the Fremont Fire Department responded to 157 Cardio/Pulmonary arrests. Thus, early notification of emergency response services is paramount to successful resuscitation efforts.

SUMMARY

Rapid and effective performance of assigned tasks is the hallmark of an effective response force. An effective response force must arrive on scene in a timely fashion if they are to perform their job functions effectively. All phases of emergency service, be it system notification time, system response time or system impact time, are greatly impacted by the passage of time. Final outcomes of said service can be negatively influenced, and survival rates lowered significantly, through longer response times. The Fire Department should constantly evaluate and re-evaluate every service delivery component and, any and all changes that effect response time, in order to ensure the effective delivery of emergency service.

SECTION V

CRITICAL TASK ANALYSIS FOR THE FREMONT FIRE DEPARTMENT

Risk Based

A risk analysis based upon building characteristics and life hazards was conducted for the City of Fremont. To analyze risk in Fremont, a software program called Risk, Hazard, and Value Evaluation (RHAVE) was used. The Commission on Fire Accreditation and the United States Fire Administration jointly developed the RHAVE program. Using the RHAVE program, each sub district in the city was examined and using the predominate building/hazard type, a risk rating was given to each sub district. The ratings were rated Low, Moderate, or Significant. Of the 117 sub districts in the city, 95% were identified as being of Moderate Risk.

We found that in sub districts with a Moderate Risk rating, the predominate building type was a two story single-family dwelling or two-story garden style apartment. Many other building types exist, but this type is the predominate building found in Fremont. This building type is also associated with the majority of Fremont's structure fires. Fire Departments face fires in many different types of buildings but initial staffing levels are generally done with the predominate building type in mind.

Critical Task Analysis

After analyzing risk and establishing goals, we conducted a Critical Task Analysis. This analysis determines what tasks need to be accomplished on the scene of an emergency. We examined our current deployment levels to structure fires and recorded the times necessary to complete the critical tasks on a structure fire and EMS calls. To extinguish a structure fire there are many tasks that need to be accomplished in the initial minutes of the incident. There are similar requirements for a medical aid emergency. These are called Critical Tasks and they are often done simultaneously, and in some cases sequentially, on the scene of an emergency. The term 'simultaneously' means that as companies arrive on scene, different personnel are assigned specific critical tasks at the same time so that the department's goals can be accomplished through safe and effective emergency operations. The term sequential means that as companies arrive on scene different assignments are given at the discretion of the Incident Commander.

When assigning personnel to complete tasks, firefighter safety is always the first consideration. The second consideration is assigning the proper number of personnel so that the critical tasks can be completed in an effective manner and time frame. There were nine critical tasks identified that need to be accounted for simultaneously on all Moderate Risk structure fires. The first five of these tasks need to be accomplished by a team of a minimum of two firefighters. Having a fully staffed fire

company complete these tasks greatly increases their effectiveness on the fire ground. To minimize the loss of life and property, and account for firefighter safety, the following critical tasks need to be completed simultaneously on all moderate structure fires. These include:

Attack Line – A hose line staffed by a minimum of two firefighters, capable of delivering a minimum of 150 GPM. This is the minimum for effective fire attack, but it has been identified that a larger hose line staffed by three firefighters would be optimum.

Back-Up Line – Usually this hose line is the same size as the attack line and is staffed by a minimum of two firefighters. However, the hose line could be larger than the attack line. It is used to protect the fire attack crew in the event the fire overwhelms them or a problem arises with the attack crew.

Search and Rescue – A minimum of two firefighters assigned to search the involved structure for victims of smoke and fire. This crew is charged with locating and removing any victims from the structure while fire attack and ventilation are being initiated.

Ventilation Crew – A minimum of two firefighters used to provide vertical and/or horizontal ventilation. Ventilation is a time consuming and labor-intensive operation. It is greatly enhanced when more than two personnel are assigned to this critical task. A crew of four personnel can allow both vertical and horizontal ventilation to be accomplished effectively and timely.

Rapid Intervention Team – A minimum of two firefighters staged in a ready position near the entry point of the involved structure. This crew is utilized to provide search and rescue for lost or injured *firefighters* inside the structure. As the incident escalates, this crew should be comprised of a full company of personnel.

> ***Note: OSHA TWO-IN/TWO-OUT; Health & Safety Code Section 29 CFR 1910.120 (q)(3)(vi)***
>
> *When the Occupational safety and Health Act was enacted in 1970, it required that employers comply with all occupational safety and health standards promulgated under the authority of the act. In 1997 the Occupational Safety and Health Administration enacted the Standard for Respiratory Protection regulation. In this Respiratory Protection Regulation, specific sections address firefighters and firefighting and it is called the Two-In/Two-Out regulation.*
>
> *The Two-In/Two-Out rule states that whenever firefighters enter an atmosphere that is defined as Immediately Dangerous to Life and Health (IDLH) they must do so in teams of at least two, and operate in direct voice or visual contact – and that at least two fully equipped and trained*

firefighters must remain outside the structure, monitoring those inside prepared to rescue them. One of these firefighters must be free of all other tasks in order to account for, and if necessary, initiate a rescue of the firefighters inside. The other firefighter is permitted to perform other tasks, but only if those tasks could be immediately abandoned without jeopardizing the safety and health of others at the emergency scene. OSHA regulations allow deviations to regulations involving a life-threatening situation where immediate action is necessary. Such deviations must be the exception and not the rule.

The OSHA Two-In/Two-Out Regulation also states that a rescue team (for firefighters) must be assembled on scene and ready for deployment at all times during a structure fire while self contained breathing apparatus is being used by firefighters.

The Fremont Fire Department has SOPs for establishing a rescue team for firefighters on all structure fires. This rescue team is called the Rapid Intervention Team (RIT). The RIT is used to rescue trapped, injured, or lost firefighters inside a burning or collapsed structure. The Fremont Fire Department always assembles this team at some point during fire ground operations. However, the first arriving apparatus does not have the personnel to initiate interior Fire Attack with two firefighters and have two firefighters standing by outside as the RIT.

Under OSHA regulations, this company may begin interior operations in this circumstance only if an obvious rescue situation exists. If there is no obvious rescue situation then the company must wait until an additional company arrives on scene and is ready to function as a RIT. While having a rescue team ready for downed firefighters is desirable, a further delay initiating interior Fire Attack operations allows the fire to grow larger, hotter, and more dangerous, with the possibility of flashover further threatening firefighters and destroying property.

Pump Operator – A firefighter assigned to operate the pump controls on the attack engine. This firefighter is responsible for delivering the required water pressure to the attack lines.

Water Supply – A crew of one or more firefighters who must provide an uninterrupted water supply to the attack engine. This is usually accomplished by using five-inch supply hose.

Command – An officer assigned outside of the structure, who coordinates the fire attack. This officer will evaluate the strategy being used and change that strategy if needed.

Safety/Operations – An officer that assists command directing crews on scene. This officer is responsible for making sure that safe firefighting operations are being deployed.

By having personnel on the fire ground complete the critical tasks on a structure fire within the first 10 minutes, the Department's goal of limiting the fire to the room of origin can be accomplished. This requires a certain level of staffing on the effective response force and specific task assignments needs to be made. The optimum staffing level and tasks assignments are seen in the charts below.

The above critical tasks are those that must be done simultaneously in the early stages of fire attack. All structure fires are different with no two being exactly the same. Other fire ground tasks may need to be completed in the early stages of the fire. Those include:

- Forcible entry
- Exposure lines
- Medical care to victims or firefighters
- Water supply problems
- Utilities

There are also secondary tasks that must be completed on the fire ground after the critical tasks are accomplished. They include salvage, overhaul, secondary search, fire investigation, and an evaluation of the building's safety.

To analyze the department's ability to complete critical tasks on the fire ground, we developed a scenario, which helped us understand when tasks are getting completed on the fire ground. To choose an appropriate scenario in which we evaluate our critical task abilities, we used information gathered from the Risk Assessment. The Risk Assessment determined that the predominate building type in Fremont was of moderate risk and usually consisted of a two story single family dwelling or two story garden style apartment.

Using Fremont Fire Department's current standard operating procedures during our analysis, we developed a hypothetical situation using the current full alarm response assignment and normal operating procedures. The training tower at station seven was used as the fire building. The response assignment of three engine companies, one Truck Company, and two Battalion Commanders were used in the scenario. The situation used was a typical structure fire incident encountered in Fremont. The operations incorporated into the scenario were familiar to all participants.

The fire problem, in the hypothetical situation, was straightforward with no unusual difficulties encountered by the fire suppression personnel. It did not include fire victims, forcible entry problems, water supply problems, access problems or any of the number of things that can and do go wrong on the fire

ground. A significant effort was made to have the scenario as realistic as possible. It is important to keep in mind that the time necessary to accomplish the critical tasks on the drill ground are often much quicker than during real incidents. Drill participants were familiar with the building being used and there was no smoke, heat, darkness, risk, or unknown situations to slow down the operations.

Scenario for Moderate Risk Structure Fire:

> Room and contents fire on the second floor of a two-story, 2,000 square foot single-family dwelling.

Goal of the Fremont Fire Department in Responding to Fire Calls:

> *Arrive before flashover occurs and confine the fire to the room of origin. Account for, and remove all possible victims from inside the involved and exposed structures.*

Standard Operating Procedure for Structure Fires – Current System

Effective Response Force for Structure Fires

Resource Type	**Number of Firefighters**
Engine Company	3 Firefighters
Engine Company	3 Firefighters
Engine Company	3 Firefighters
Truck Company	3 Firefighters
Battalion Commander	1 Firefighter
Battalion Commander	1 Firefighter
Total Personnel	**14 Firefighters**

Company	**Task**
1st Engine	Initiate Fire Attack
2nd Engine	Water Supply/Back Up Fire Attack
3rd Engine	(RIT) Unless otherwise assigned
1st Truck	Ventilation/Utilities/Forcible Entry
1st Battalion Commander	IC
2nd Battalion Commander	Direct interior Fire Attack/Safety

NOTE: Search and Rescue is performed by one of the above companies *after* their initial task has been completed.

The above assignments on a structure fire are a general overview of what is expected of the initial alarm response. Conditions on the fire ground may dictate a change in the standard operating procedure. The Search and Rescue critical

tasks are not usually specifically assigned at most structure fires. If there is a strong indication of a potential victim (such as a verbal report by a resident) inside the structure, typically the third due engine company is assigned the Search and Rescue function. When there is no strong indication of potential victims, there is not a specific SOP identifying which company, team, or individual is responsible for completing a Primary Search. The Primary Search is often initiated by the first or second engine company after the fire has been extinguished. For most fires, this delays the task of primary search.

Standard Operating Procedures and Current Staffing Levels for a Moderate Risk Structure Fire for the Fremont Fire Department

Critical Task Analysis

a. 911 call	:10
b. Call handling interval	1:40
c. Turnout time	1:30
d. Response time interval	4:00
Response Time Subtotal	**7:20**
First engine on scene	**0:00**
1. Size up by fire captain	1:00
2. Second engine and BC on scene	2:00
3. 1st attack line charged off apparatus tank	2:15
4. Fire attack company enters structure	3:00
5. Fire attack flowing water on fire	3:30
6. Truck, 3rd engine, and 2nd BC on scene	4:00
7. Second engine establishes water supply	4:55
8. Second hose line charged	5:30
9. Back Up crew enters structure	6:20
10. 1st ladder to roof (24' ladder)	6:25
11. Blower at front door/windows vented	6:45
12. RIT/Accountability equipped and ready	7:10
13. 2nd ladder to the roof (done by RIT)	8:15
14. Truck company (2 personnel) on roof	8:35
15. Primary search begun by Back up crew	9:50*
16. Vertical Ventilation completed	11:05
17. Primary Search completed	11:55
18. Utilities secured	12:00
19. Fire brought under control	13:30

***NOTE:** Search and Rescue was performed by the Back Up company (2nd engine company) after their initial tasks of water supply and back up were completed.

In observing the scenario, evaluators identified positive and negative elements of Department's capabilities to accomplish the critical tasks in the early stages of the operation. These findings are summarized:

Positives

- Good direction and accountability by command officers
- RIT established early
- Attack team flowing water quickly
- Fire Attack concept firmly established

Negatives

- Search and Rescue is delayed until other critical tasks are completed.
- There is no SOP identifying the crew responsible for Search and Rescue.
- Great distances often separate personnel handling the hose lines while they are maneuvering hose around corners and furniture. This can place the firefighter who is on the nozzle, often the least experienced firefighter, closest to the fire.
- The truck company can only accomplish one critical task – Ventilation
- Truck company tasks take more time to accomplish due to the nature of the work assignments and lack of an adequate number of personnel.
- If there is no obvious rescue situation, the first company on scene must wait for the second company to arrive on scene before entering the structure.

Observations

The number of personnel currently dispatched on the current first alarm assignment does not allow the Fremont Fire Department to accomplish all of the critical tasks needed simultaneously on the fire ground during the early stages of the operation. Early stage is defined as within the first 10 minutes. Both the first and second engine companies on scene generally initiate Fire Attack, establish a water supply, and deploy a back up fire attack line based upon departmental policy. The truck company typically begins aggressive horizontal and vertical ventilation.

Two of the five critical tasks needing to be accomplished as quickly as possible are Search and Rescue and RIT. This requires the Incident Commander to make a decision regarding the Third Engine deployment. Search and Rescue functions are considered by most fire service professionals as the fire department's primary mission, and are the most important task on the fire ground. Having a fully staffed Rapid Intervention Team while firefighters are operating inside a burning structure is identified in OSHA regulations. If the third engine company assumes RIT/Accountability functions, then either Fire Attack or

the Back-up company performs the primary search after their initial critical task is completed. This causes a delay from arrival on scene until the primary search is initiated of between This can be critical because our experience has shown that upon our arrival there is not always a bystander waiting to tell firefighters that there is a victim in the structure.

Common fire service beliefs maintain that a building occupied 24 hours per day, (ie., a single family dwelling, apartment, unit, etc.), is considered 'occupied' until a Primary Search proves otherwise. Also, Search and Rescue functions on the fire ground are the first priority. Placing a hose line on the fire is often the single best thing that an engine company can do on the fire ground with a search of the building done simultaneously with Fire Attack. Unless a rescue is obvious, the Fremont Fire Department places the RIT function as a high priority. If a rescue is obvious, then Search and Rescue delays the implementation of the RIT function. The Fremont Fire Department's Search and Rescue SOP states that the Department will initiate a Primary Search in all involved and exposed occupancies that can be entered. It does not state which company or team of firefighters will initiate the Search and Rescue function of a Primary Search. The SOP does state that all activities on the fire ground will support the Search and Rescue function and all structures are considered occupied. In reality, the Search and Rescue function is not consistently accomplished within the same time frame.

Initial Critical Tasks Necessary at a Moderate-Risk Structure Fire

Task	**Firefighters**
Attack Line	2
Back Up Line	2
Support for Hose Lines	2
Search & Rescue	2
Vertical Ventilation	2
Horizontal Ventilation/Forcible Entry/Utilities	2
Rapid Intervention Team	2
Pump Operator	1
Command Officer	1
Safety Officer	1
Total Effective Response Force	**17**

Initial Critical Tasks Necessary At A Significant Risk Structure Fire

Task	Firefighters
Attack Line	2
Back Up Line	2
Hose Line Support	2
Exposure Line	2
Search & Rescue	4
Forcible Entry	2
Vertical Ventilation	4
Horizontal Ventilation	1
Pump Operator	1
Aerial Operator	1
Incident Commander	1
Safety/Accountability	1
Rapid Intervention Team	3
Total Effective Response Force	**26**

MEDICAL EMERGENCIES

Medical aid emergencies are time sensitive and require the prompt response of paramedic crews. There is a direct correlation between elapsed time and increase in a patient's morbidity and mortality. In cardiac arrest or heart related medical emergencies, blood flow to the brain is essential. Irreversible brain damage will occur in four to six minutes according to the American Heart Association. Cardiopulmonary resuscitation (CPR) and defibrillation by residents and firefighters has a direct correlation in decreased mortality.

Fremont's medical deployment policy is designed using Total Reflex time to ensure that irreversible brain damage due to cardiac emergencies will not occur. The deployment of resources begins with Fire Department dispatchers prioritizing the call through the Emergency Medical Dispatch system, along with providing pre-arrival instructions. Engine and truck companies equipped with advanced life support equipment are dispatched simultaneously with paramedic ambulances. The Department is contractually obligated by the Alameda County EMS Agency to a response performance standard of 10 minutes in 90% of the time.

Included in the medical deployment policy is citizens' CPR. CPR training programs by the Fire Department with local citizens are an essential piece in reducing irreversible brain damage. The Fire Department provides both a standard CPR certified program and a CPR Prompt® take home non-certified program following American Heart Association guidelines.

The graph on the next page displays emergency calls by time of day in two increments: medical calls and all other calls. The period from 0800 hours until 2000 hours is the most active time of day. This is also the time of day when calls begin to cluster and response reliability or equity issues develop.

CRITICAL TASKS ANALYSIS OF EMS CAPABILITIES

Goal of the Fremont Fire Department in Responding to EMS Calls:

> *Arrive on scene and provide advanced life support to all patients before irreversible brain damage occurs in the cardiac arrest patient.*

In the May 1996 edition of the Journal of Emergency Medical Services magazine, the Fremont Fire Department was recognized as having one of the highest save rates for cardiac arrest victims in the United States. In an effort to measure the Department's capabilities of handling emergency medical calls, we conducted a critical task analysis on our current delivery of services. A specific type emergency medical case was needed in order to analyze a fire company's ability to complete the critical tasks in an orderly and timely manner. The cardiac arrest call was selected as the benchmark for the critical task analysis. It was chosen because it represents the most serious medical emergency the Fremont Fire Department responds to, with approximately 150 cardiac arrests calls per year. Cardiac arrest cases are challenging for EMS personnel because they require basic and advanced life support skills and fully involve all personnel during the resuscitation efforts.

In order to complete a critical task analysis of our EMS capabilities, the scenario of a cardiac arrest was analyzed utilizing the Department's state-of-the-art patient simulator, SimMan, to measure the performance of an engine company. This training aid is designed to automatically and accurately document the procedure times in which specific treatments and skills are performed on the manikin. The simulations were video taped. The goal of the critical task analysis was to use the Department's current staffing model while performing the scenario. In addition, critical time-sensitive tasks needing to be accomplished were identified.

ADVANCED LIFE SUPPORT FOR A STAT EMS CALL

Scenario: Critical Respiratory Emergency – Pulmonary Edema

1 – Engine or Truck Company	3 – Firefighters *
	* One firefighter is a Paramedic

TASK	TIME	CREW MEMBER
Arrival on scene	0:00	Full Crew
Scene safety	0:45	Captain
At patients side	1:02	Full Crew
Check ABC's	1:20	Paramedic
Verbal patient history (on going)	1:45	Paramedic
Lung Sounds	2:00	Paramedic
Oxygen	2:07	EMT #1
History from bystanders/family (on going)	2:10	EMT #2
Skin Signs	2:30	Paramedic
Vital Signs	4:05	EMT #1
Administer Nitroglycerin	4:15	Paramedic
Prepare IV solution	4:25	Paramedic
Establish IV	5:05	Paramedic
EKG Monitor	5:21	EMT #1
Obtain list of patient's meds	5:50	EMT #2
Suction	6:00	EMT #1
Secure IV	6:24	Paramedic
Draw up Lasix medication	8:30	Paramedic
Administer Lasix	9:20	Paramedic
Vital Signs (2^{nd} set)	9:35	EMT #1
Administer Nitroglycerin (2^{nd})	9:50	Paramedic
AMR ambulance on scene	10:00	N/A
Prepare Morphine medication	10:35	Paramedic
Patient report given to AMR	10:45	Paramedic or EMT #2
Administer Morphine	11:10	Paramedic
Ventilate patient with AMBU bag	11:35	EMT #1 and AMR crew
Patient on gurney	13:10	Full Crew and AMR
Transport by ambulance	18:00	AMR crew
FFD paramedic accompanying AMR to assist with patient care	18:00	Paramedic
Clean up of hazardous waste on scene and restock of equipment	22:00	EMT #1 and EMT #2

The above critical task analysis is of a typical, critical medical emergency in Fremont. In 2002, this type of medical emergency occurred 638 times. It should be noted that this analysis was based upon a simulated exercise conducted in real time utilizing a full crew of responders and a specialized resuscitation-training aide known as SimMan. SimMan is a computerized manikin.

On all emergency medical incidents, a paramedic ambulance from American Medical Response (AMR) is dispatched to the scene. The AMR ambulance is staffed with one paramedic and one EMT and, has a County mandated response time standard of arriving on the scene within 10 minutes and 30 seconds 90 % of the time.

CRITICAL TASK ANALYSIS OF A CARDIAC ARREST CALL

Current staffing level response to an emergency medical call

1 – Engine or Truck Company	3 Firefighters*
	* One paramedic and two EMT's

TASK	**TIME**	**CREW MEMBER**
Arrival on scene	0:00	Full Crew
Scene safety	0:45	Captain
At patient's side	0:59	Full Crew
Assess level of consciousness	1:08	Paramedic
Position patient	1:20	Full Crew
CPR compressions begun (on going)	1:30	EMT #1
OPA inserted	1:45	EMT #2
Ventilation with AMBU (on going)	2:00	EMT #2
EKG monitor	2:05	Paramedic
Defibrillation #1	2:34	Paramedic
Pulse check	2:38	EMT #2
Defibrillation #2	2:54	Paramedic
Pulse check	2:58	EMT #2
Defibrillation #3	3:11	Paramedic
Pulse check	3:15	EMT #2
ETT Intubation	6:15	Paramedic
IV established	7:45	Paramedic
Epinephrine (1st med.)	10:48	Paramedic
Amiodarone	11:12	Paramedic
Defibrillation #4	12:08	Paramedic
Epinephrine #2	12:35	Paramedic
Defibrillation #5	13:45	Paramedic
Lidocaine #1	14:05	Paramedic
Defibrillation #6	14:49	Paramedic

TASK (cont.)	TIME (cont.)	CREW MEMBER (cont.)
Epinephrine #3	15:22	Paramedic
Defibrillation #7	16:15	Paramedic
Lidocaine #2	16:40	Paramedic
Defibrillation #8	17:26	Paramedic
Place patient on backboard	20:00	Full Crew
Transport by AMR with one or two FFD personnel	23:00	Paramedic and EMT #1
Clean up scene	28:00	EMT #2

The above critical task analysis is of a cardiac arrest emergency. This type of medical emergency occurred 157 times in 2002. It should be noted that this analysis was based upon a simulated exercise conducted in real time utilizing a 3-person crew of responders and a specialized resuscitation-training aide known as SimMan. SimMan is a computerized manikin.

On all emergency medical incidents, a paramedic ambulance from American Medical Response (AMR) is dispatched to the scene. The AMR ambulance is staffed with one paramedic and one EMT and, has a County mandated response time standard of arriving on the scene within 10 minutes and 30 seconds 90 % of the time.

Note: 1. The first medication was given at 10:48.
2. Assumes County Ambulance provider arrives on-scene within 10 minutes and 30 seconds 90% of the time.

With the Department's current staffing level standard of two EMT's and one paramedic on an engine or truck company, the initiation of drug therapy occurs at 10 minutes and 48 seconds. This time frame is due to the fact that on a cardiac arrest, the EMTs are committed to performing basic life support skills, which include cardio-pulmonary resuscitation (CPR) and airway management. This leaves the paramedic with many tasks to complete, which include defibrillation, suction, intubation, IV access, and medication administration. The paramedic must complete each task before another task can be begun. This delays the administration of critical life saving medications to the patient beyond ten minutes into the resuscitation efforts. With our current staffing level, it is difficult to obtain the patient's medical history from the family or witnesses. The medical history is often obtained while completing another task and is usually conducted with family or witnesses observing the resuscitative efforts, something that is not desirable but necessary in most situations.

In a review of the Patient Care Tracking System (PCTS), forty-four cardiac arrest calls in Fremont were identified during 2001 and 2002 in which a spontaneous pulse returned to the patient during resuscitative efforts. These forty-four cardiac arrest patient reports were reviewed to look for any consistencies in the treatment or outcomes for these patients.

44	Total Patients
22	Patients in Ventricular Fibrillation or Ventricular Tachycardia upon arrival on scene (lethal dysrythmias)
11	Patients in Asystole (flat-line) upon arrival on scene
11	Patients in other heart rhythms upon arrival on scene
39	Patients resuscitated after administration of medications
4	Patients resuscitated after placement of Endotracheal tube
1	Patient resuscitated after AED by bystanders

Note: Based upon a study of 44 resuscitated cardiac arrest patients during 2001 and 2002, Fremont's experience is that the ambulance provider arrives on scene an average of 3.87 minutes after the Fire Department.

After reviewing the data, not a single patient treated by the Fremont Fire Department during the years studied was successfully resuscitated by initial defibrillations alone. The only spontaneous return of pulses occurred at the New United Motors Manufacturing Incorporated (NUMMI) plant. In this case, plant personnel using an Automated External Defibrillator (AED) prior to the Fire Department's arrival performed the defibrillation. All remaining patients that experienced a return of pulses did so only after advanced life support therapy was administered.

The majority of these patients had a return of pulses after the administration of ALS medications. The return of pulses after medications ranged from the first dose of medication all the way to a return of pulses after the fifth dose. In many instances, pulses returned after medications and defibrillation were administered.

The administration of medications was always done after the intubation and IV access was obtained per protocol. The average arrival time of an AMR ambulance after the Fire Department's arrival on scene for these cardiac arrest cases was 3.87 minutes. The majority of these resuscitations occurred in districts 1, 3, 6, 7, and 8 with few resuscitation efforts in districts 2, 4, and 5. These response districts typically have a longer response time for ambulances, which delays the arrival of the second paramedic on the scene. Data identified the ambulance response to districts 2, 4 and 5 is longer than the remaining response districts. Our research identified that the EMS cases in which spontaneous return of pulses occurred, are those in which the ambulance arrives shortly after Fire Department personnel.

The above-mentioned research indicates that the sooner ALS skills are performed, the better the chances of patient survival are. When reviewing the time marks for the critical task analysis, with the enhanced staffing levels of two paramedics and two EMTs, it is possible to improve patient outcome.

Findings

1. The Risk, Hazard, and Evaluation portion of this study has provided the Department with an understanding of the different hazard levels within Fremont. While there are areas in Fremont which have significant risk, it has been identified that the predominate risk level in Fremont is moderate with scattered areas of higher risk. This has further allowed the Department to analyze its performance in dealing with emergencies that are typical to this community.

2. After determining what type of buildings in Fremont the majority of the structure fires occur, we were able to identify how effectively the Department performs the critical tasks necessary to extinguish these fires. In addition, we were able to identify the critical tasks performed on a cardiac arrest patient. Analyzing the timeframe in which fire companies accomplish these critical tasks on the scene of an emergency allows the Department to evaluate its effectiveness in meeting its fire suppression and EMS goals.

3. Our evaluation of staffing on fire companies demonstrates that there are critical tasks that cannot be accomplished within the 10 minute timeframe. This is true for both fire and EMS emergencies. In order to achieve the effective response force for the City of Fremont, consideration in the recommendation section regarding staffing will be discussed.

SECTION VI

EVALUATION OF RELIABILITY OF FIRE COMPANIES

The Department has used a five-minute arrival time 95% of the time for its response time standard since the early 1980s. The standard as written however is not clear in terms of what is actually being measured or why five minutes was chosen. In terms of hostile fires, the Department goal is to arrive prior to the occurrence of "flashover." Flashover is the point in the evolution of a fire that all ordinary combustibles in a room reach their ignition temperature simultaneously and begin to burn without direct flame contact. When flashover occurs, room temperatures immediately exceed 1000 degrees Fahrenheit, property damage increases exponentially, occupants cannot survive in the environment and the danger to firefighters is much higher. Flashover can occur within 10 minutes of a fire entering the free burning phase and depending upon the level of hazard in the room, has been documented as early as two minutes after flames are seen.

Medical response is focused on minimizing the period of time from when assistance is needed and emergency intervention begins. In a recently published article (and as borne out in our local experience) the potential to convert pulseless, non-breathing patients suffering from a heart attack decreases every minute with approximately six minutes as the point when irreversible brain damage will begin. These two types of incidents are the motivation for locating fire stations to support a rapid response of emergency resources and standards that are monitored.

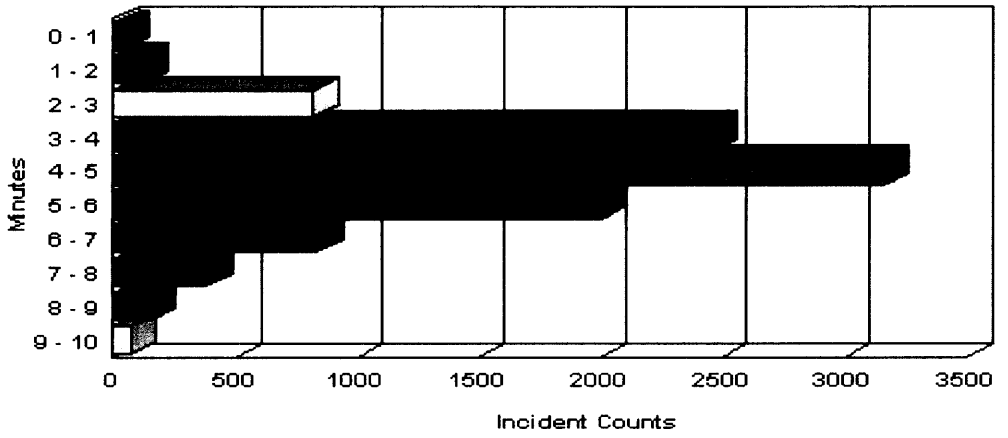
The 9-1-1 process begins with the receipt of a call in the Fremont Police Department Communications Center. After a very brief interview, the call is then transferred to the Alameda County Regional Emergency Communications Center for processing. The Fire Department has defined two standards related to receiving a request for assistance: call answering time and call processing time. The call answering standard requires that emergency phone calls must be answered within 10 seconds, 90 percent of the time. The call processing standard requires that emergency calls are handled (an alert transmitted to the appropriate companies) within 60 seconds 90 percent of the time.

Upon receipt of a reported emergency, the responding personnel are expected to leave the station wearing the appropriate level of protective clothing within 90 seconds 90 percent of the time. The final component is travel time from the station to the incident. If the five minute standard documented in the City's adopted General Plan includes all of these intervals then it is clear from a review of the Department's historical performance that we are not meeting the standard and have not been for some time. Based upon this information, it is recommended that the response standard be clarified to include all components of emergency response and to evaluate and balance the standard to consider the

historical performance of the Department in terms of experience and outcomes with respect to its development.

With current technology and accurate data from the Department's computer aided dispatch (CAD) system, we have been able to measure our actual response times and periods of emergency activity. Figure 6.1 displays the historical data for the year 2002.

Figure 6.1



The City of Fremont enjoys a very good outcome and performance experience as demonstrated by the low incidence of casualties and fire fatalities, property loss/property saved ratio and high resuscitation rates when compared with national averages. In terms of our standard, while many progressive, high performing fire departments have adopted a response standard of 90 percent achievement, only one has been identified as being set at 95 percent for response time performance. The ICMA Benchmark Consortium has indicated that a 90 percent rate is the baseline for urban/suburban fire departments and all but one of the departments that have been surveyed use 90 percent as their benchmark for response time measurements. Also, as earlier mentioned, the existing standard is vague in terms of many of the components involved in emergency response so it is appropriate to revise the measurement as defined in the Objectives Section of this document.

It should be noted that several factors have an impact on the department's ability to respond to emergencies. The City population has increased from 132,000 in 1980 to 209,500 in 2003. Silicon Valley activity, particularly in the southern end of the community, has created traffic congestion and a mix of potentially hazardous uses in a relatively defined area. In addition, the Department has

experienced a significant increase to the numbers of freeway and bridge responses over the years. There are several factors that have contributed to this increase:

- Recognition by the public of the fire service role in EMS and rescue
- Advent of 9-1-1
- Advent of cellular telephone technology
- Necessity to send fire apparatus in two directions to all highway responses
- Increased traffic
- Increased highway construction projects and road hazards
- The proliferation of cellular telephones

The Fire Department call volume over the years tends to be very consistent and to some extent predictable. Although each year the number of calls increases, each category of emergency responses is proportionate, and typically falls within a certain time frame. When measuring responses by hour of the day (as described is Section II), day of the week and by month, each year's data appears to be consistent. More frequently, the Department is experiencing an increase in the number of times simultaneous calls occur. This can and does impact response times, but can be a challenge to measure with our current CAD system. Somewhat more predictable are specific types of critical calls. Cardiac arrests, critical trauma, and structure fires have very clear periods of peak activity. Figure 6.2 shows current cardiac arrest call volume by time of day, Figure 6.3 shows critical trauma by time of day, and Figure 6.4 shows working structure fires by hour of day.

Figure 6.2

Cardiac Arrest by Hour of Day

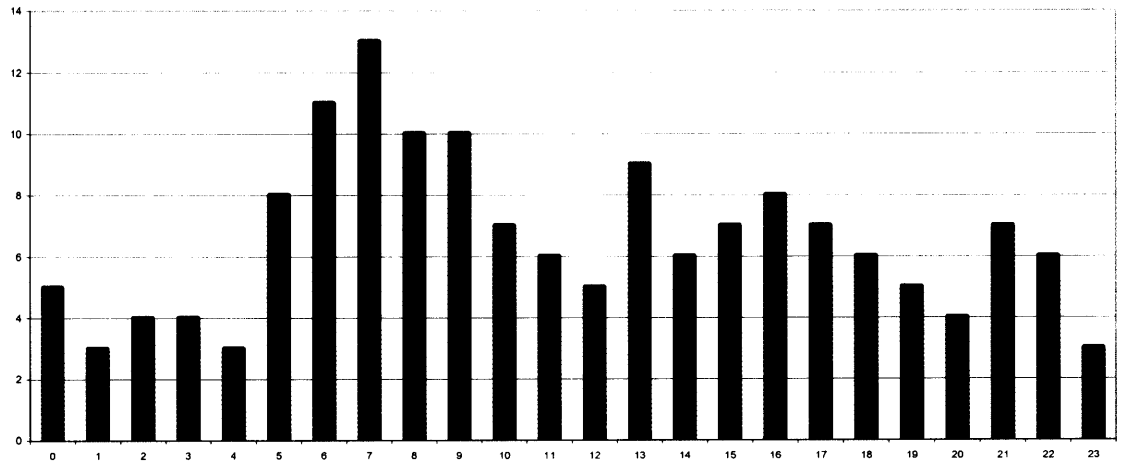


Figure 6.3

Critical Trauma Patients by Hour of Day

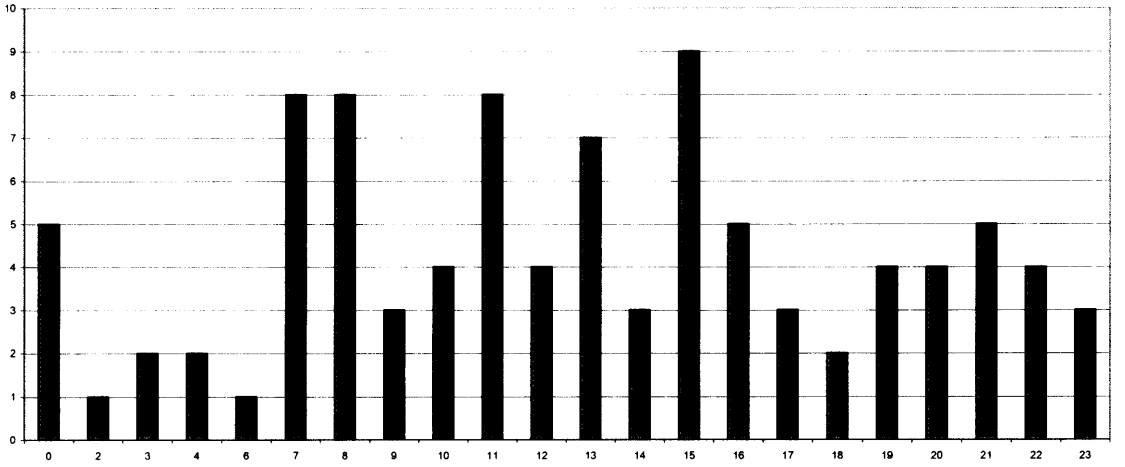
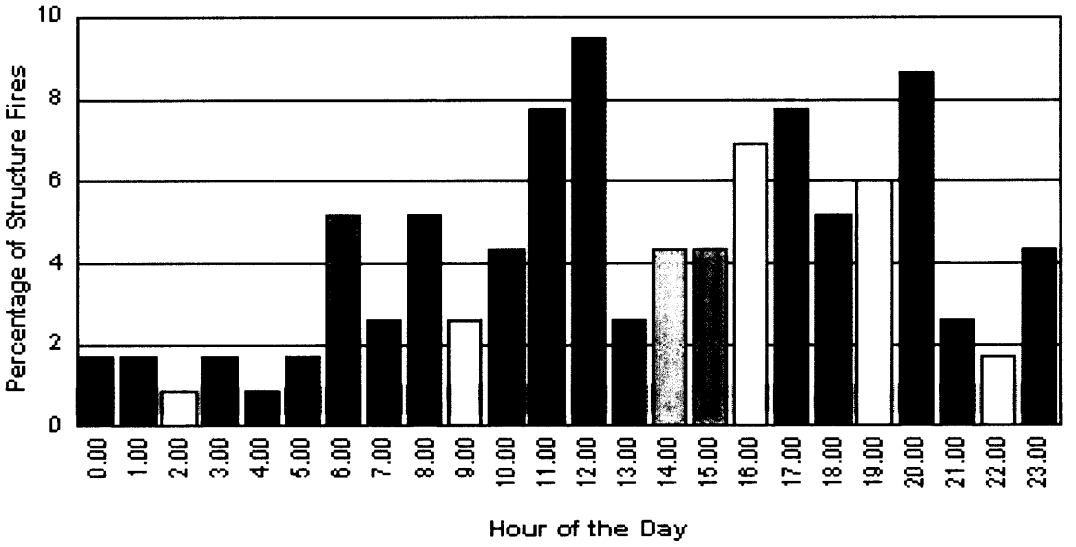


Figure 6.4

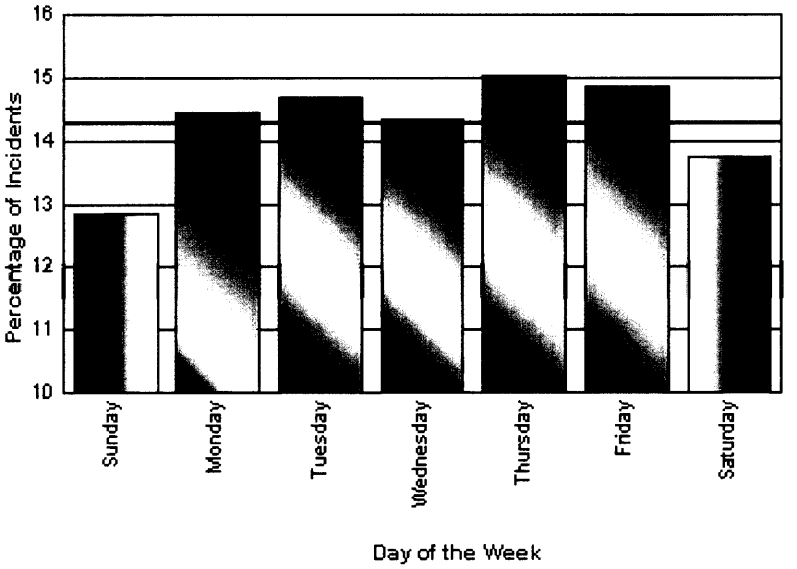
Structure Fires by Hour of Day



On a daily basis, Fremont Fire Department emergency call volume is consistent, with the peak day being Thursday. This trend is very similar to national fire service data statistics as reported by the United States Fire Administration (USFA) through the National Fire Incident Reporting System (NFIRS). Figure 6.5 displays this data.

Figure 6.5

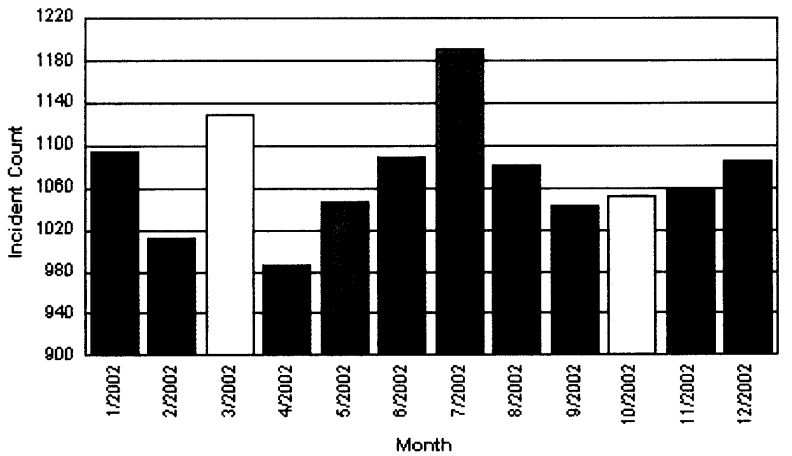
Structure Fires by Day of Week



The Fire Department experiences seasonal call volumes for various reasons. During winter, structure fires and EMS responses (flu season) are more prevalent. Injury accidents and brush fires occur with more frequency during the summer months. During autumn, weather conditions are mild, with lower humidity and higher temperatures. Depending on the weather patterns for the year, August and September can actually be the months with significant fire responses within the City limits. These months are also the periods of the year where our commitment to mutual aid, both local and distant, is the highest. Figure 6.6 shows all emergency responses by month.

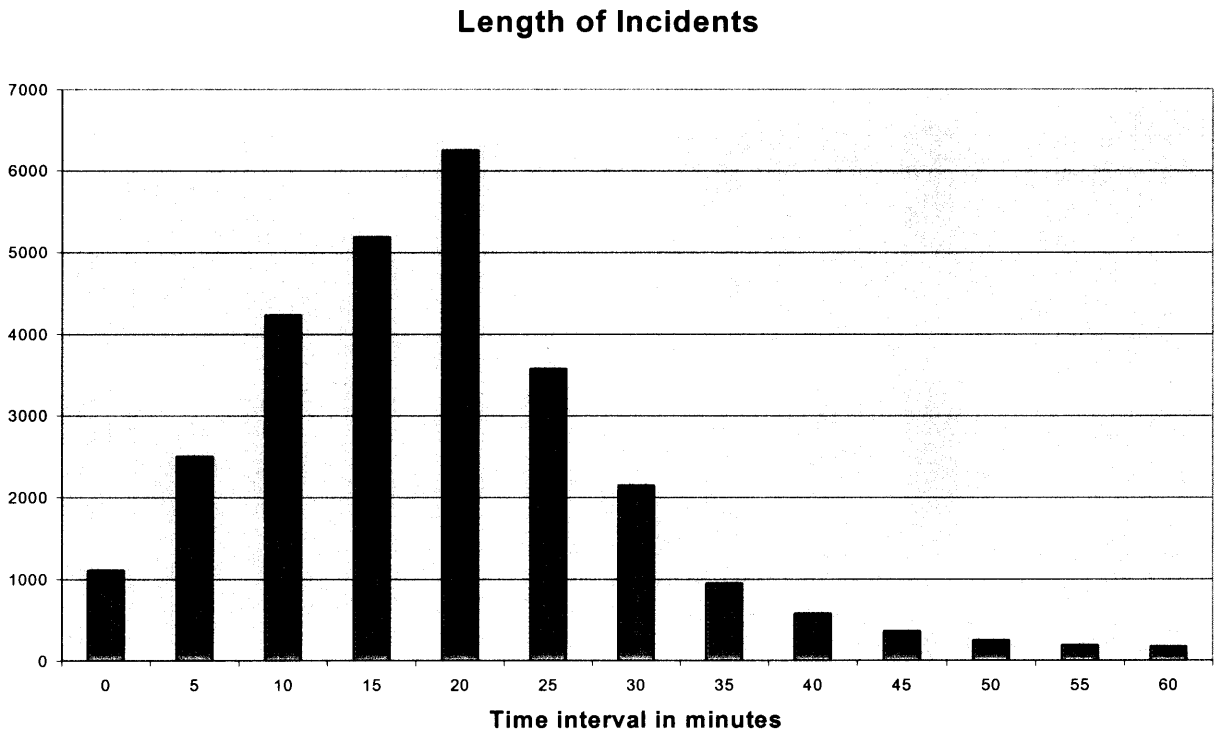
Figure 6.6

Incidents per Month 2002



The average length of call is displayed in Figure 6.7. Consideration must be given to the fact that there are usually multiple incidents and/or daily activity occurring at a given time.

Figure 6.7

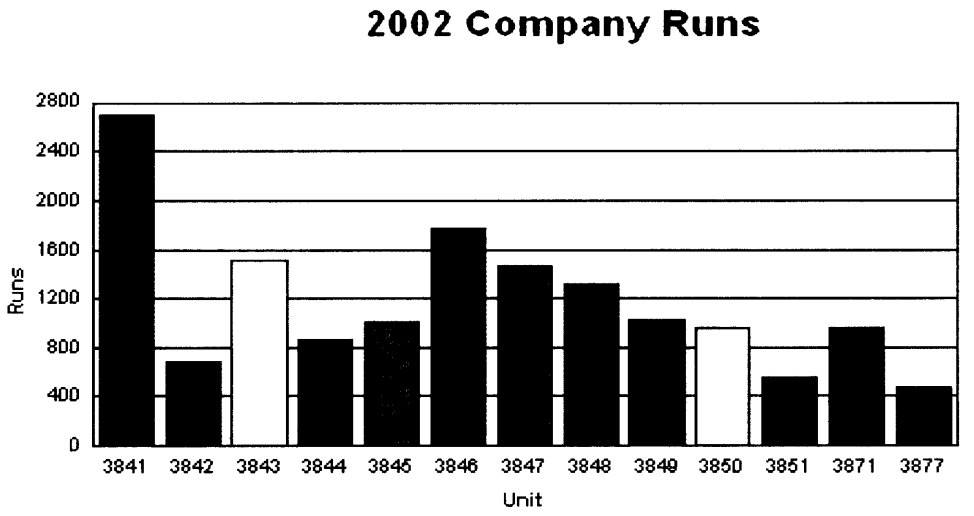


The above data depicts the Department's response performance for emergency activity. What the data and charts do not display are all of the other peripheral events that transpire on a daily basis. There are many other events that consume considerable amounts of staff time each day. These include, but are not limited to the following items:

- Fire apparatus inspections and servicing
- Fire station maintenance
- Training
- Fire inspections
- Pre-fire planning
- Station tours and public service appearances
- Report writing
- Special projects
- Company officer meetings

There are other activities that consume a portion of each workday relative to emergency and non-emergency responses. The Department policy for fire district coverage requires fire apparatus to move up when more than two adjacent districts are vacant for any reason. Figure 6.8 identifies all company runs for the year 2002. The number of company runs will always be greater than the total number of calls. This is because many calls require the response of more than one engine or truck company.

Figure 6.8



A. Evaluation of Draw-Down

At present we have 10 Engine Companies and 2 Truck Companies. They are responsible for covering a population of 208,000 and cover an area of over 92 square miles. The Fremont Fire Department has a policy regarding move ups and station coverage, as it relates to drawn-down. Warm Springs shall have a move-up engine assigned to District 5 whenever a situation occurs that Engine 5 is committed for a considerable length of time, typically 30 minutes in duration. All scheduled training is considered as a move-up situation for Engine 5. This is based on the time distance differential this particular district suffers, due to the station location, and extended response times from the surrounding next due companies. It should be noted that Station 11 was closed in 2003, which has contributed to the deterioration of the department's ability to provide area coverage to District 5. Station 4 and/or Station 7 are utilized for move and cover depending upon their availability.

In addition to District 5's coverage problem, a move up condition exists in the City of Fremont whenever the following situations occur:

1. A working fire is declared
2. Three or more adjacent companies are committed
3. A second alarm is dispatched, or simultaneous incidents occur in one area of the jurisdiction, with the exception of Dist. 1 and Dist. 7. These two districts have and Engine and a Truck responding from these districts.

By policy we have determined that the city of Fremont has "primary coverage" stations/districts. As resources are drawn down due to call activity, the remaining fire companies shall be relocated as follows: From North to South, Stations 8 (Darwin), 1 (Central Station), 9 (Stevenson Place), 7 (Auto Mall), 5 (Warm Springs).

If overall coverage continues to fall below 5 Engine Companies, the Communication Center will activate a response alert per the South Zone Mutual Aid Plan. This resource order gives the requesting jurisdiction an alarm assignment of 3 Engines, 1 Truck and a Battalion Chief. However, if numerous single company responses are the cause for resource depletion, Fire Communications has the option to request single resources from the closest City to the problem coverage area.

B. Evaluation of Resource Exhaustion of the Department.

In the History of the Fremont Fire Department, there has only been one occasion that the City exhausted all the fire resources; including those outlined in the County Mutual Aid Plan. The incident was the Vargas Hill Fire in 1999. In that instance, the State Mutual Aid plan was utilized to supplement the resources needed to mitigate the incident.

C. Evaluation of Performance on Annual Basis

HISTORICALLY APPLIED STANDARDS

The City of Fremont's General Plan, has assigned the Fremont Fire Department a response time standard of 5 minutes 95% of the time for all calls.

Starting with a series of fire station locations "inherited" from the original five districts that now make up the Fremont Fire Department, the department has attempted to apply a greater degree of science to locating new fire stations.

Many communities attempt to rely on externally developed standards as the basis for locating fire stations. While both of the standards discussed below are

at least somewhat relevant to the Fremont Fire Department, neither provides a firm basis upon which to make station-siting decisions, for reasons that will be more fully articulated.

As was discussed earlier in this document, the current locations of Fremont Fire stations 2 (Niles), 3 (Irvington), 5 (Warm Springs) & 6 (Centerville) were located based on historic community determinations made by the individual townships, based on community demographics, call volumes, etc. Fire Station 4 (Mission San Jose) was relocated in 1990.

HISTORICAL DECISION - MAKING

As the City of Fremont has grown over the past 20 years, Fremont Fire Department has relied upon an application or interpretation of the time temperature curve as a basis for the physical locations of its fire stations. This application, agreed upon as the most useful methodology available at the time decisions were made, endeavored to place the first arriving fire company at the scene of an emergency within 5 minutes of notification to the 9-1-1 center of an alarm.

The General Plan goal is to place the first company on scene within 5 minutes. However the current General Plan does not include the recognition of alarm processing time or turn out time. Recognizing that in this department we are utilizing 60 seconds for alarm processing and 90 seconds for turn out, the remaining travel time element is a two minute and thirty second (2 minutes: 30 seconds) performance window. Using travel time alone as a reflection of service level helps us develop a station service area (polygon), which could be served within a four minute drive time. Considering this information, it is recommended that the response standard be clarified to include all components of emergency response and that travel time be set at four minutes.

It is important to note that the 5 minute figure and its sub- component times were intended to be "response goal" even though they were somewhat ambiguous. Actual response time performance is influenced by a variety of factors, including traffic patterns, simultaneous emergencies, companies away from stations for training, and a myriad of other factors. Time of day, the specific characteristics of the road network, and the other activities, all effect response performance response performance to a particular location by as much as 100 per cent.

The department utilizes GIS technology to identify station polygons and identify service areas for analysis. A portion of the GIS measurement provides a polygon that discusses the distribution and concentration response frames for each station and department as a whole.

TIME AND INTERVAL DESCRIPTION METHODOLOGY

While average times and statistical means have some utility, they are not useful measures of performance unless coupled with some measure of central tendency such as the variance or the standard deviation which described the "shape" of the performance curve.

Because many citizens will have difficulty grasping these statistical concepts, the use of "percentile analysis" is gaining great favor with the operations analysis community. Using this methodology, an organization can clearly articulate its performance standards and goals in a manner that will be easily understood. For example, "The fire apparatus will leave the station within 30 seconds of alarm activation, at least 75% of time," is a goal that can clearly be understood by everyone.

COMMUNITY STANDARDS AND VALUES

In the end, it is the City of Fremont, through its elected officials, which defines the standard of cover that will be adopted by a community. By its economic decisions with respect to taxation, the community buys a level of "fire and life safety insurance" that is consistent with its perceived needs and its available resources. While these decisions may be influenced by such factors as insurance ratings prepared by the Insurance Services Office (ISO), the level of protection available in any community is a local decision that should be made only after rigorous study of local needs and resources.

OTHER FACTORS

Response intervals are a critical element in determining optimal fire station location. Statistical analysis generally focuses on the travel time for the first-due engine company to arrive. While this is certainly an important factor, other factors are also significant.

In the last chapter we discussed Critical Tasks. Five critical tasks need to be performed during the initial stages of a structural fire: placement of attack lines, back-up lines, ventilation, rapid intervention crews and search and rescue. In addition to these actions designed to mitigate a structural fire, other tasks such as protection of exposures and forcible entry are necessary to protect the fire fighters inside a hostile environment. The accomplishment of these tasks requires the full compliment of apparatus and staffing assigned to a first alarm assignment. More severe or complex incidents such as a fire in a significant risk occupancy require that additional alarms be called to insure that adequate personnel, apparatus, and equipment are on scene to effectively mitigate the incident.

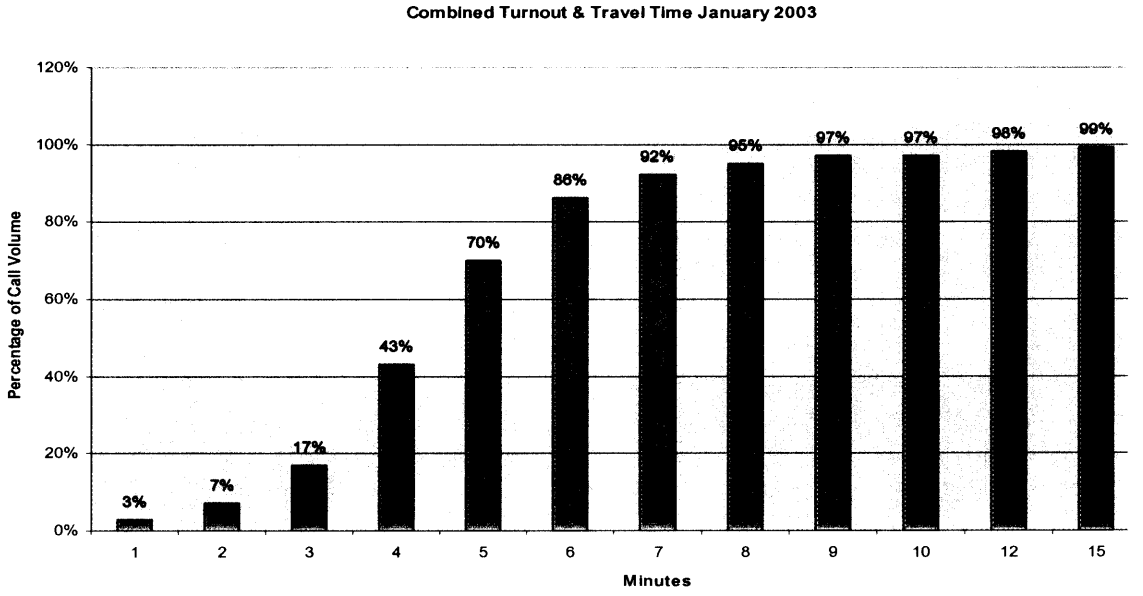
In a broader context, fire station location studies need to analyze regional responses and the impact that adjacent fire station response areas have on each other. Often times the first due companies may already be committed to previous alarms or are out of their immediate area for a training or public education function. The ability to fill out responses from adjacent fire stations becomes an important factor in determining adequate fire protection.

Recent mandates from the State Occupational Safety and Health Division (OSHA) have placed restrictions upon the actions of firefighters in a hostile environment without adequate backup personnel. These restrictions are to ensure firefighter safety, but they place a greater importance on the timeliness of assembling all personnel on scene, not just the first due company.

D. RESPONSE PERFORMANCE ANALYSIS

Utilizing statistics from the Fremont Fire Department's CAD/RMS we have analyzed our performance with respect to measurement of our call processing and turn out times.

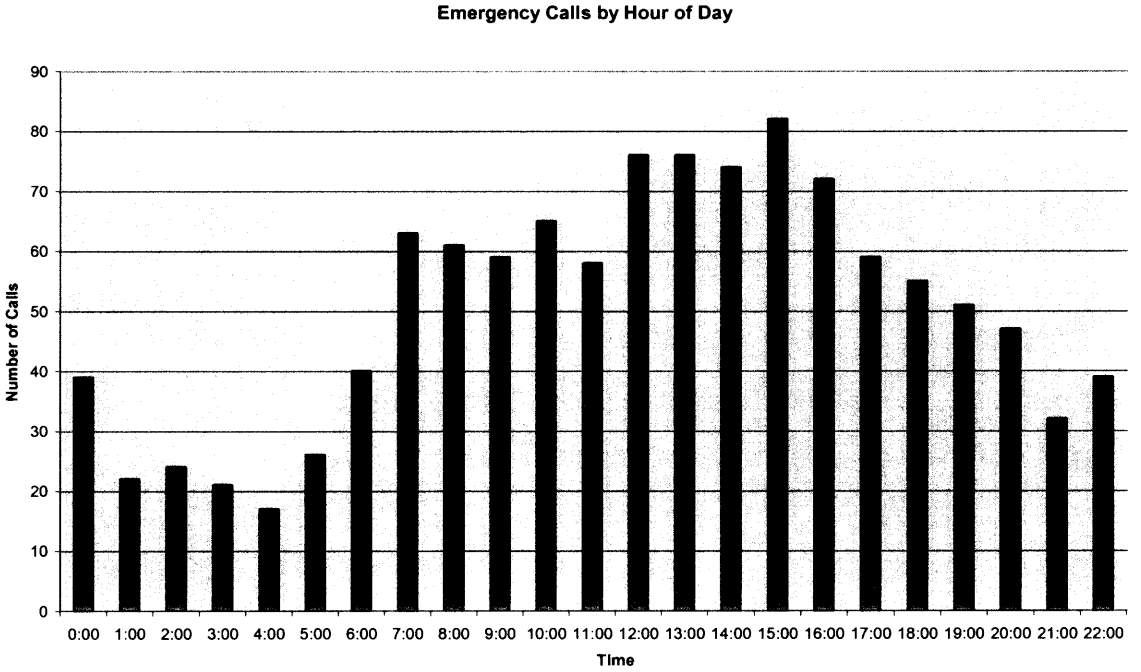
Figure 6.9



The chart above reflects the combined turnout and travel time for January 2003. Technology is not yet in place to provide an accurate measure of each item separately. The standard for turnout time is 90 seconds or less, the travel time standard is 4 minutes or less. Resources arrived within 5 minutes or less 70 % of the time for the month of January.

Furthermore, we looked at call distribution by hour of day to indicate workload as indicated in the chart below:

Figure 6.10



Base upon records maintained by the Fremont Fire Department, we conducted a review of the distribution and concentration of actual emergency responses. Utilizing FireView software, the department conducted a review of the frequency and distribution of all emergency calls. Contained in the map atlas are pin maps, which indicate the location of fires, EMS calls and hazmat calls for service. Furthermore, FireView software was used to develop a "Hot Spot" map, which illustrates proximity of multiple calls for service.

EXCEPTION REPORTING

Several factors that are beyond Fremont Fire Department's control may adversely impact emergency response times. When calculating response time performance, Fremont Fire Department will remove those calls where exceptions to normal "code three" response are factors. These exceptions are listed in detail under Section Ten, but will include, at a minimum, the following incidents:

- Adverse weather responses (rain, floods, etc.)
- Calls initiated as "Code 3", and unit is slowed to "Code 1" en-route
- Unexpected delays (trains, construction, extreme traffic not normally encountered)
- Freeway responses

ECONOMIC EXCEPTIONS

Since the Standard of Response Cover project was started within the Fremont Fire Department there have been several economic factors that have been brought to bear. One of these considerations has been the closing of a fire station. The station that was selected in this decision process was Fire Station11. However, it was not chosen arbitrarily. Using FireView Software, the stations were all reviewed in terms of workload, temporal analysis and response time cover. Station 11 was selected because it met the criterion of having the least impact on the most measurable parameters. As a result of this decision, the City of Fremont will have some under-served area. The annual evaluation of the criterion used in making that decision requires that actual performance data be used to determine the threshold of restoring the station when appropriate.

RESPONSE RECOVERY DECISIONS

When an area is under served this is based upon the response time criterion for the most part, i.e., the area does not have a projected coverage within the response time goals of the department. However, actual response times are a better form of evaluation. Under served areas need to be analyzed at least once a year.

Distribution

The General Plan statement for the distribution of emergency resources is ambiguous and does not take into consideration our knowledge for important time elements such as alarm processing and turn out time.

Concentration

The General Plan is silent on the issue of Concentration. Considering contemporary SOC methodology, this needs to be identified and adopted as part of our Standards of Coverage.

Company Reliability

The reliability of emergency resources is an important consideration and should be factored into decisions regarding resource deployment. Reliability is directly related to the incident call volume within a company's first due district. The higher the call volume of a company, the less available or reliable the company is to respond to incidents within its own district. The result is longer response times and increased potential for unwanted outcomes of emergencies. While distribution of fire stations is primarily based upon placing companies close enough to the areas that they are expected to respond to, reliability and concentration are also very important considerations. The unique characteristic

of importance relative to company reliability in Fremont is that the three districts with the highest concentration of call volume, (Districts 1, 3 and 6) are adjacent to each other and have accounted for approximately 50 percent of the incident volume in the City over the past three years. The impacts to response times can and are significant as a result. (See chart below)

Reliability of first due companies 2002

Engine Company	% Availability to respond to calls within district
Engine 1	76.9%
Engine 2	91.8%
Engine 3	90.1%
Engine 4	85.89%
Engine 5	88.26%
Engine 6	87.79%
Engine 7	79.87%
Engine 8	80.83%
Engine 9	87.91%
Engine 10	82.24%
Engine 11	80.1%

E. Maintenance of Effort

Staff will review response performance for each responding company on a monthly basis. Performance measurements and objectives will be checked against actual experience each year during the month of February for the past calendar year. The Department's confinement success rate, resuscitation percentage, extrication performance and other published outcomes and outputs will be evaluated and efforts to make improvements in deficient areas will be considered. Performance will be published and distributed to all Department personnel as a Directive. A report containing the results of the analysis shall be sent to the City Council each year.

Occupancy, hazard information and violations noted will be updated as inspections are completed. New tenant information will also placed in the Department GIS database and complex cards carried on responding apparatus and at the Communications Center.

F. Overall Evaluation of Company Reliability

In completing this Standards of Cover Report and documenting the incidents of concurrent calls for service, training and administrative activities, district coverage and other impacts to resources, is was determined that our company reliability is lower than previously identified. Our response performance has

been good based upon the data however; clarification is needed of our distribution and concentration response criteria. The Department has done a good job with existing resources as evidenced by the annual fire loss experience and more importantly, the value of property saved. Casualties and fire deaths have also been historically low as has fire related injuries to Department personnel. Advanced Life Support data including the percentage of code resuscitations and vehicle extrications has also been very strong historically.

Reliability of companies and the Department's ability to place an effective response force at the scene of an emergency however is impacted by incident volume and the type and intensity of incidents relative to location, which are areas in need of improvement. Section VII will identify the findings of this process and propose recommendations for improvements for consideration. In recommending these improvements, staff has evaluated the cost benefit of improvements, timing of implementation and anticipated outcomes if approved.

SECTION VII

POLICY RECOMMENDATIONS

The Process

The process of conducting a Standards of Response Cover Study is designed to provide the Fremont Fire Department with a rational; data based method of locating and deploying its Fire Department resources. The previous six chapters have been used to develop a full inventory of local fire, EMS and other environmental hazards present within our community. The goal of this study is to conduct an evaluation of the Fire Department's performance against its adopted goals.

The predominate building type presents a moderate hazard and the eastern perimeter of the City is designated as a very high fire hazard area. In identifying our operational service objectives in terms of response performance, we first considered the location of the existing fire stations to determine if the sites support the Department's response goals. Larger incidents require additional resources generally for extended periods of time and require the determination of the ability to place the appropriate number of resources at the scene of an emergency based upon critical tasks, within a defined period of time. A third review is conducted to assess the availability of resources to respond to incidents and how this factor impacts response time performance.

In completing the Standards of Coverage, staff and field personnel have a more comprehensive understanding of the department's ability to provide fire protection and related services based upon this database of information. The department has identified areas and operating practices that are in need of redefinition and resolution.

Findings

Upon completion of this comprehensive and analytical evaluation of the response capabilities of the Fremont Fire Department, it has been determined that the department has a high overall performance ability. However, areas of improvement have been identified relative to distribution (the location of resources), concentration of companies (placing the appropriate number and types of emergency resources at emergencies), reliability (the availability of emergency resources to respond to incidents) and the completion of critical tasks.

The findings of this process are as follows:

1. In order to minimize response times, some re-assignment of areas of the City (station districts) is needed to ensure the closest company is responding.

2. Fire stations 2, 3, 6, and 8 restrict emergency operations by limiting the preferred placement of emergency response resources.

3. We have relocated the dispatch center and will be evaluating a new paradigm for the turnout and alarm processing time component.

4. In response districts 8 and 10 in the northern area of the City, there is a larger coverage overlap than recommended or required. Overlap for all stations is needed for concentration purposes. *(Please see the Map Atlas, M-10," District 8 & 10 4-minute drive time overlap").* Considering that station relocation is part of this future recommendation, this overlap will be continuously evaluated after final site selection.

5. Trucks 1 and 7 are assigned to fire stations 1 and 7 respectively. This results in response coverage overlap for much of the high value area but results in extended response times to the northern and southern areas of the City. *(Please see the Map Atlas, M-11, Truck 1 & Truck 7, 8-Minute overlap"; M-12, Truck 1 & Truck 7 beyond 8-minute drive time").* The result is Truck service in North Fremont, specifically Districts 2, 8 and 10, and in South Fremont, districts 4,5 and 11, is in excess of our adopted response goal of 8 minutes.

6. Districts 5, 6 and 11 have areas within them where we cannot achieve our response time goals.

7. We have shut down Fire Station 11. This has increased distribution (response) times for the area previously protected by this company. The average response time prior to and after closure of 11 was five (5) minutes: 13 seconds and five (5) minutes: 43 seconds respectively. Response performance for incidents occurring in District 11 for calendar year 2003 is more than one (1) minute above the Department average of four (4) minutes: 30 seconds.

8. The removal of Station 11 has had an impact on the concentration capability in districts 5 and 7 because it can no longer contribute to an effective response force.

9. Based upon our critical task analysis, all of the tasks identified as critical cannot be accomplished on routine structure fires within our response time goal with the existing response force.

    a. Based upon our critical task analysis, the department can accomplish all of the tasks identified as critical for a routine Basic Life Support EMS response.

    b. Based upon our critical task analysis, department paramedics cannot administer the first medication on a Cardiac Arrest until 11 minutes after arrival or arrival of the ambulance transport crew.

10. In the past 40 months, 50% of the requests for emergency assistance originate in three of the eleven fire districts. Further, these districts are adjacent and located in the center of the City. The impact of this intensity of call volume in these areas results in the second or third due company responding to incidents for initial response. The result is a delayed response to emergencies on the order of minutes.

11. The Fremont Fire Department needs to redefine the distribution criterion to be more consistent with departmental goals. The department does not currently achieve the General Plan response goal.

    a. The department does meet the Alameda County response time standard for medical aid incidents.

12. The Fremont Fire Department needs to adopt a Concentration criterion to be more consistent with departmental goals.

Recommendations

As a result of this study and through the research of fire protection practices and systems utilized in a variety of urban communities primarily in the State of California similar to the City of Fremont in terms of size, population, occupancy/economic valuation and hazard type, staff has developed a series of proposed response improvements. The recommended actions have been analyzed and evaluated relative to the outcomes that are anticipated if they are implemented. Additionally, the identified steps are separated into the actions that can and should be initiated by the Fire Department and those that will require additional financial resources when available or other City Council actions. It should be noted that some actions may be implemented independently, some are sequential in a specific order and others can be implemented over time. All will improve the response performance and emergency outcomes of the Fire Department if accepted.

The following recommendations are within the Fire Chief's ability to incorporate:

1. Ensure an on-going analysis of performance metrics of response capability through the use of FireView and GIS technology.

2. Complete a Citywide evaluation of first-due district assignments to ensure closest company is dispatched.

3. Assign a 5th company (engine) to all reported structure fire incidents to address the identified deficiency of our inability to complete the five critical tasks that need to be completed concurrently on routine structure fire incidents.

4. Evaluate impact of adding an additional company (at the incident and for incidents that occur elsewhere in the City) on structure responses i.e., calls responded to by 2nd or 3rd due company, unavailability of scarce resources (i.e., trucks). The information will provide the Department with the anticipated impacts of drawing down emergency response resources in terms of the Department's ability to respond to on-going emergency incidents during structure fire incidents.

5. Review and revise Standard Operating Procedures to improve effectiveness in accomplishing critical tasks on structure fires.

6. Monitor and evaluate emergency response activity and performance in District 11 and adjacent districts.

7. Relocate Truck 1 to Centerville at New Station 6. This action will improve the Department's ability to provide a more consistent level of truck service particularly in Districts 2, 8 and 10.

The following recommendations will be presented to the City Council for consideration:

1. Redefine and adopt response performance criteria (distribution criterion) in the City General Plan Safety Element to read as follows; "The Fire Department will respond to emergencies such that *after the receipt of the alarm*, the first company will arrive at the scene of an emergency within five (5) minutes: thirty (30) seconds, (1 minute: 30 sections turnout time, 4 minute travel time), 90 percent of the time.

2. Relocate Fire Stations 6 (Centerville) and 8 (North Fremont) to support the emergency response performance criteria as a part of the Fire Department Building Program.

3. Adopt the following concentration criteria: The Fire Department will respond to structure fire and other multiple company emergency alarms such that the full assignment (minimum of 14 firefighters) will arrive at the scene of an emergency within nine (9) minutes: thirty (30) seconds, (1 minute: 30 second turnout time, 8 minute travel time), 90 percent of the time.

The following actions are recommended for consideration when funding is available and will be submitted through the annual operating budget cycle:

1. Provide funding for the traffic pre-emption program. Recommendation to assist in improving response time performance.

2. Provide funding for an Automatic Vehicle Locator (AVL) Program including an interface to CAD to ensure that CAD considers the dynamic movement of available emergency resources when selecting the closest resource(s) to reported emergencies thereby reducing response times.

3. Add a three-person Rescue Company to Fire Station 1 to coincide with the relocation of Truck 1 (3871) to Station 6. Recommendation 6 will support the relocation of Truck 1 to Station 6 and address the concentration of incidents in the central corridor of the City generally and specifically within District 1. This recommendation will also support the concentration criteria throughout the City and ensure the appropriate amount of personnel are available at emergency incidents to complete critical tasks within a significant draw and impact to remaining emergency resources.

4. Construct Fire Station 11 when the development and existing building occupancy occurs in that area.

Summary

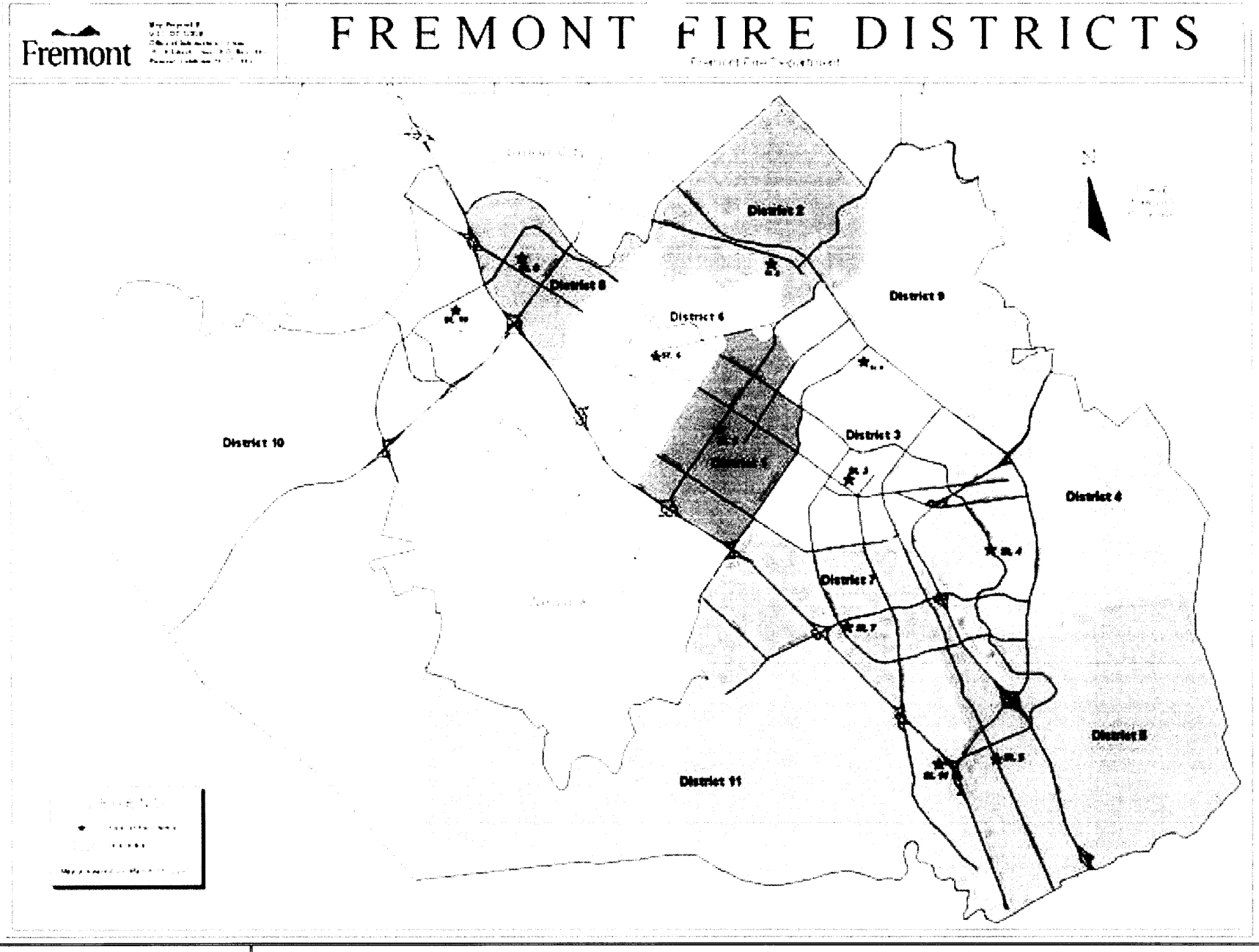
The Fremont Fire Department is an excellent response agency that is well equipped, well trained, skilled and focused on minimizing the effects of hostile fire, medical emergencies, and other environmental emergencies. The actual performance of the Department is well documented and the information provides opportunities to identify and analyze deficiencies and to recommend prudent courses of action for improvement. In cataloging local hazards and analyzing the Department's ability to respond effectively to the probable events, a series of improvements have been identified and recommended to the City Council for consideration.

The completion of this document has been very useful not only in identifying our performance and deficiencies, but in providing staff with the tools and experience to routinely assess the operational performance of the Department and to make the appropriate corrections when and where needed. Staff will annually review

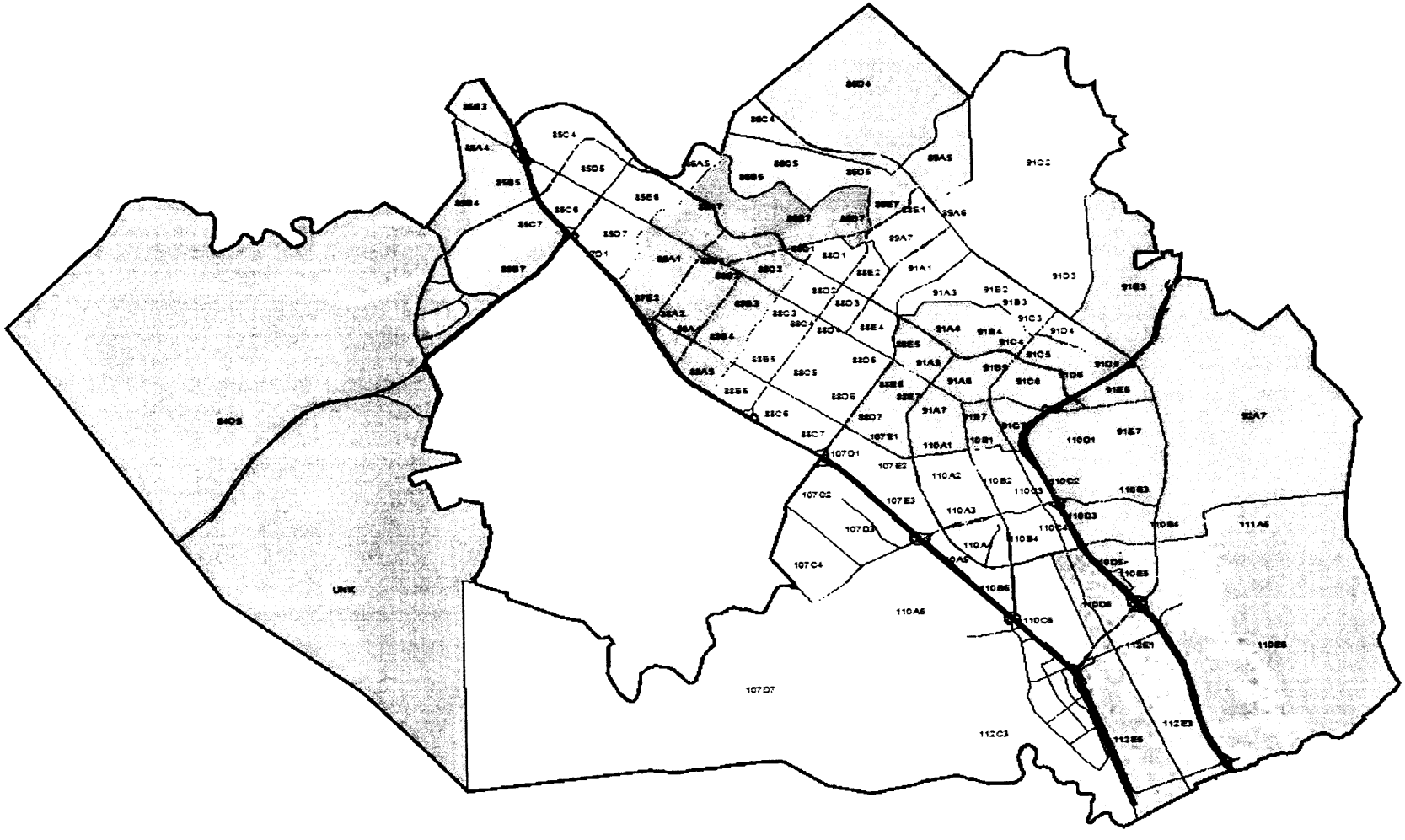
the performance of our Emergency Response Resources and provide a report to the City Council of the outcomes.

APPENDIX A

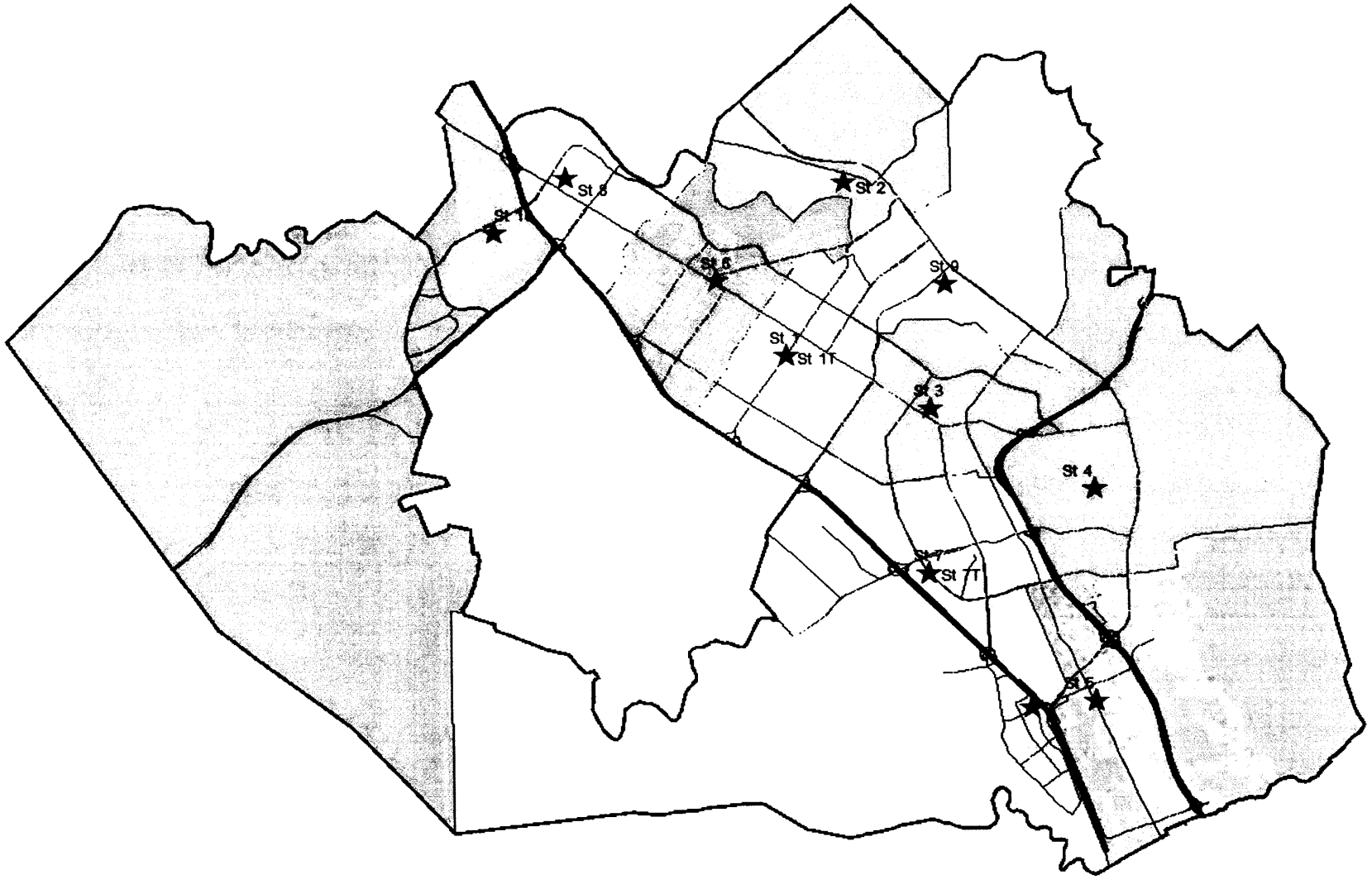
Map Atlas



M-1	Fire Districts

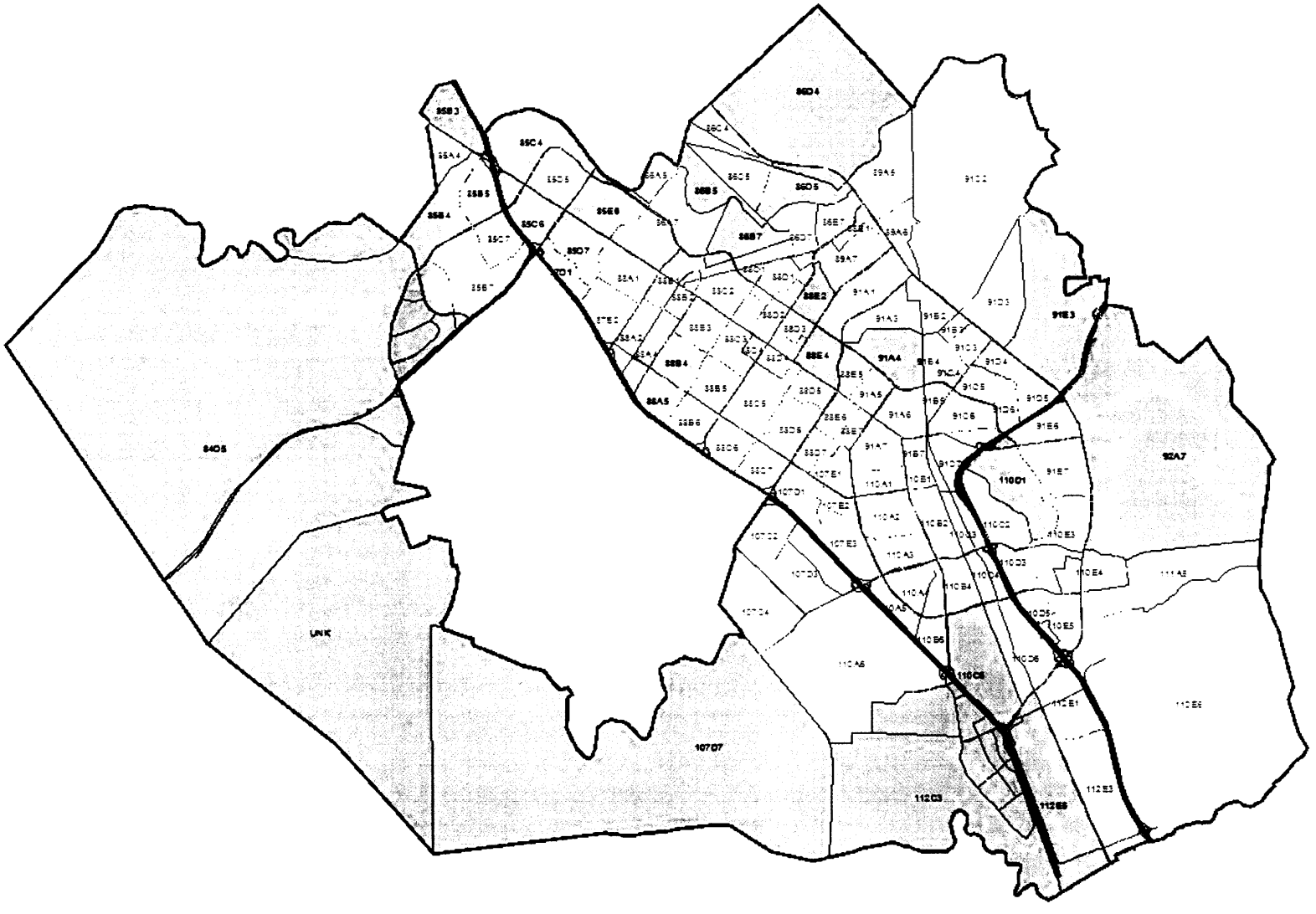


M-2	117 Sub-Fire Districts

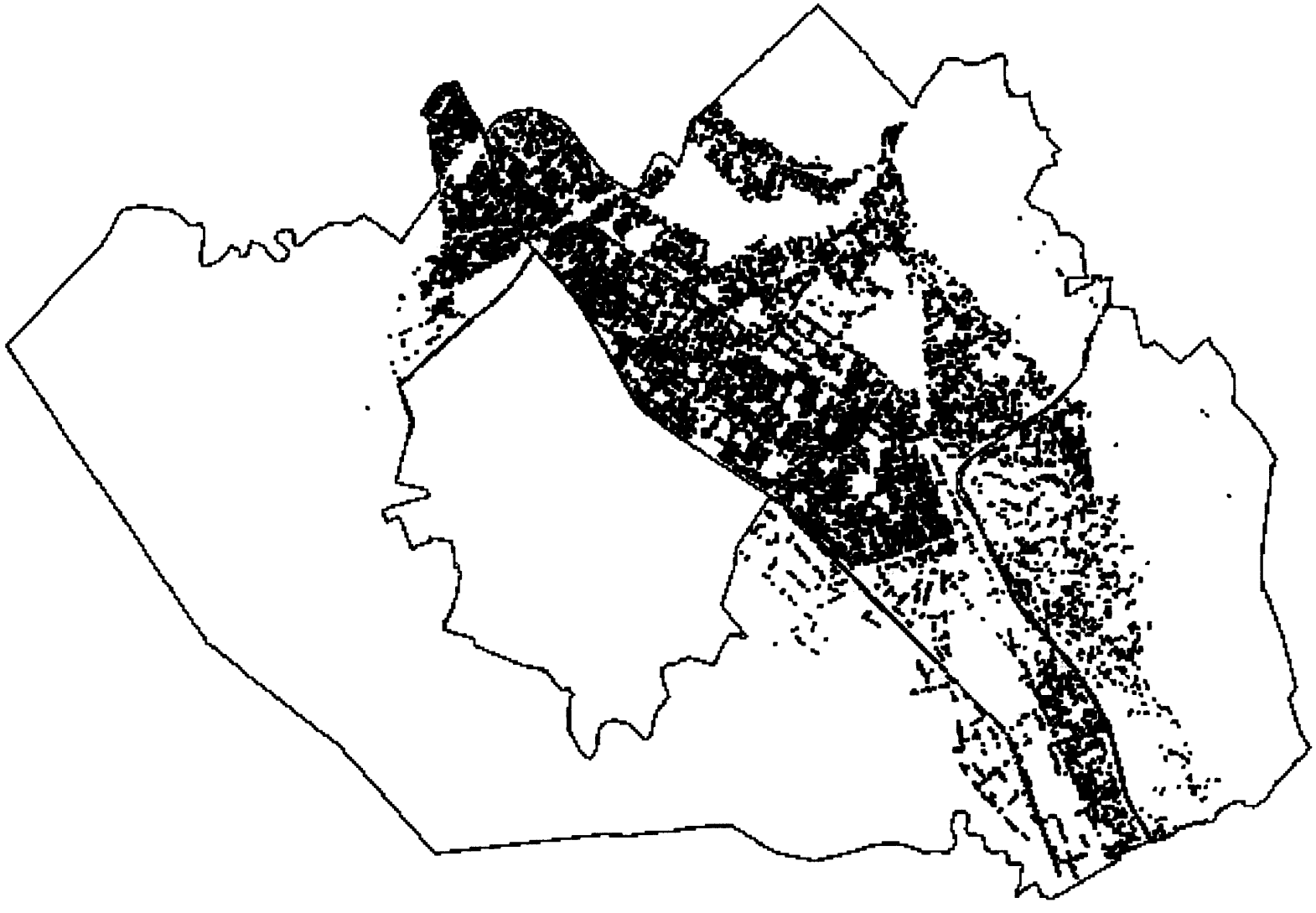


M-3	11 Primary Fire Districts with Fire Stations Locations

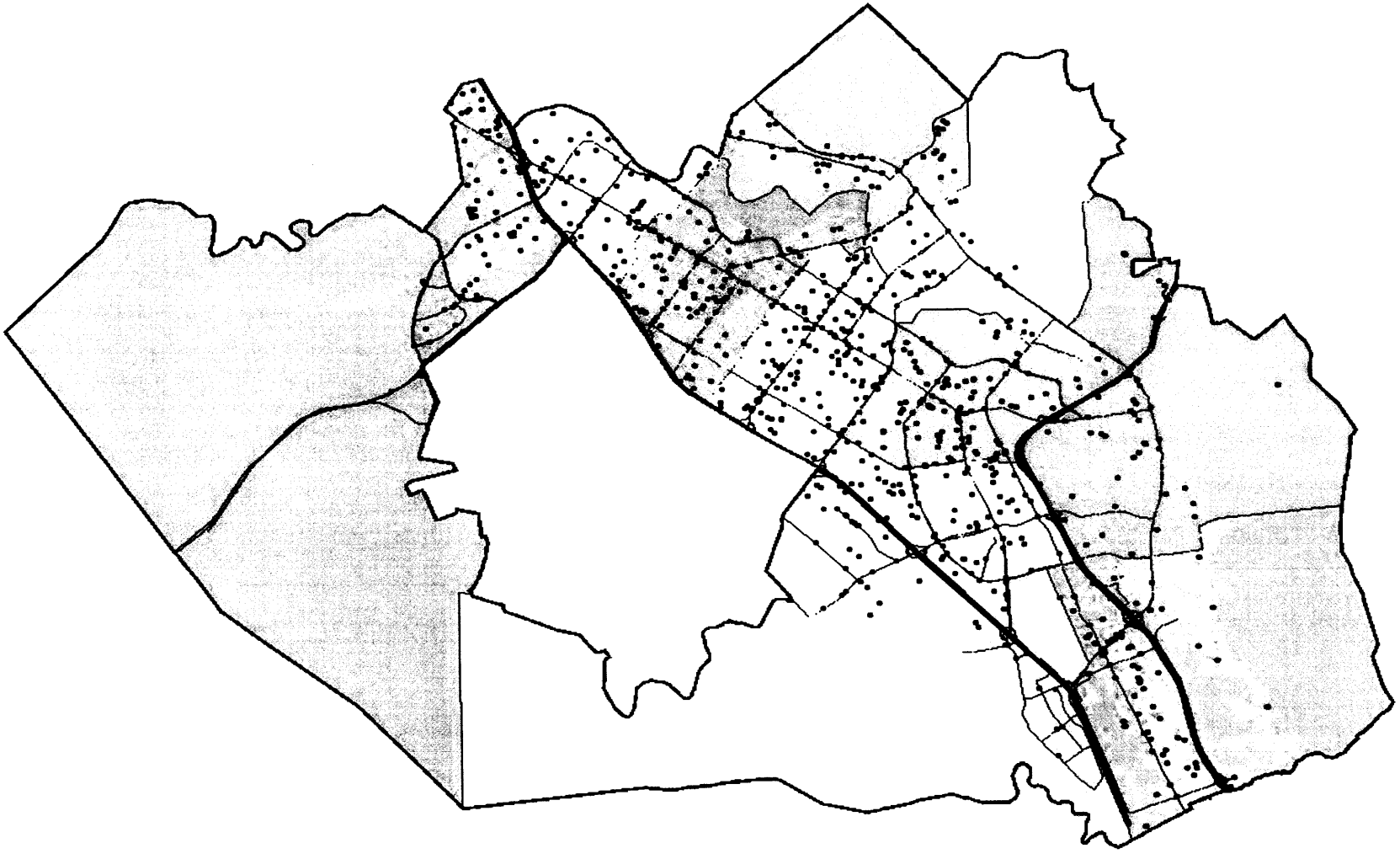

M-4



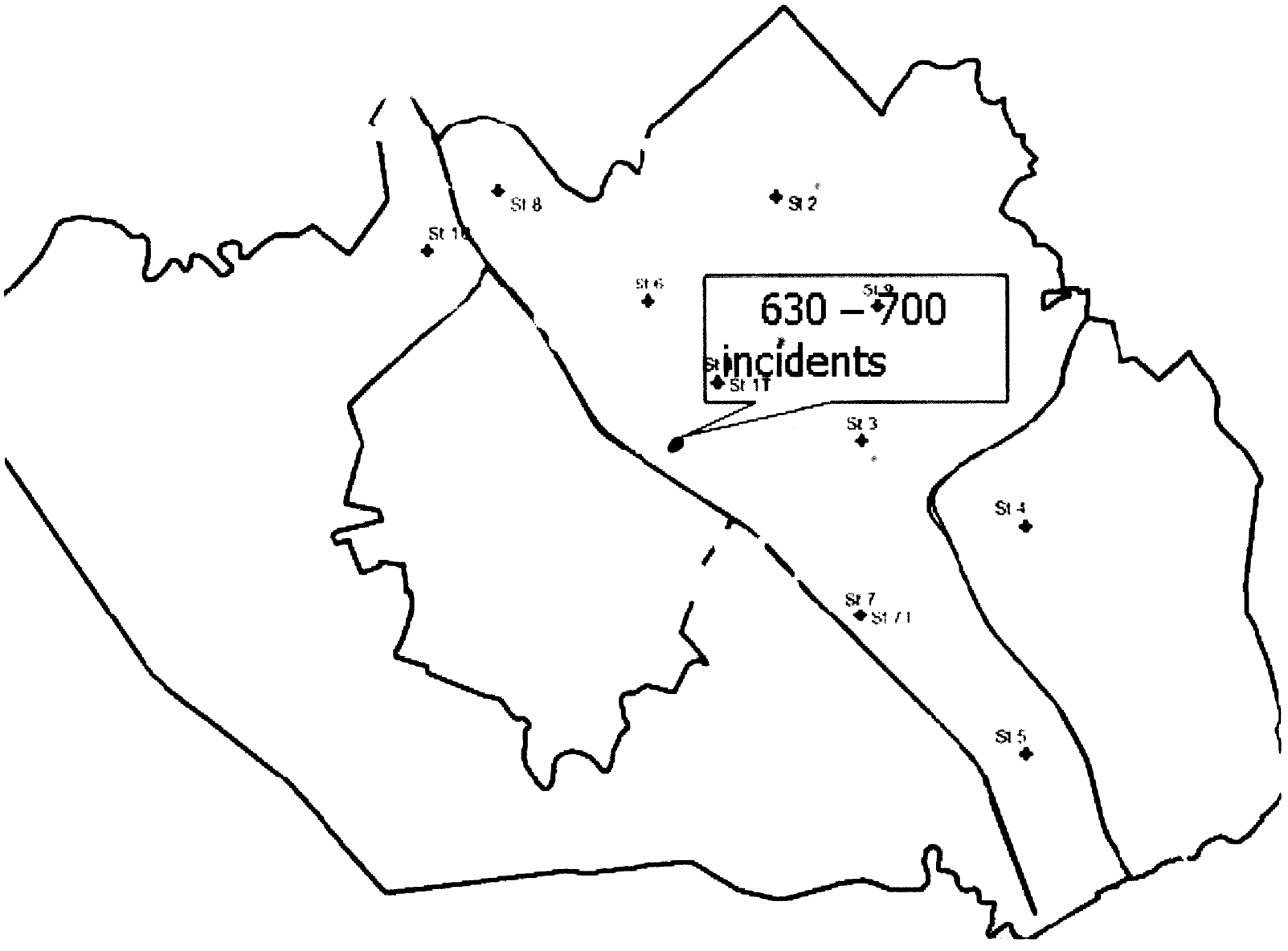
M-5	Rhave Map with Sub-Districts



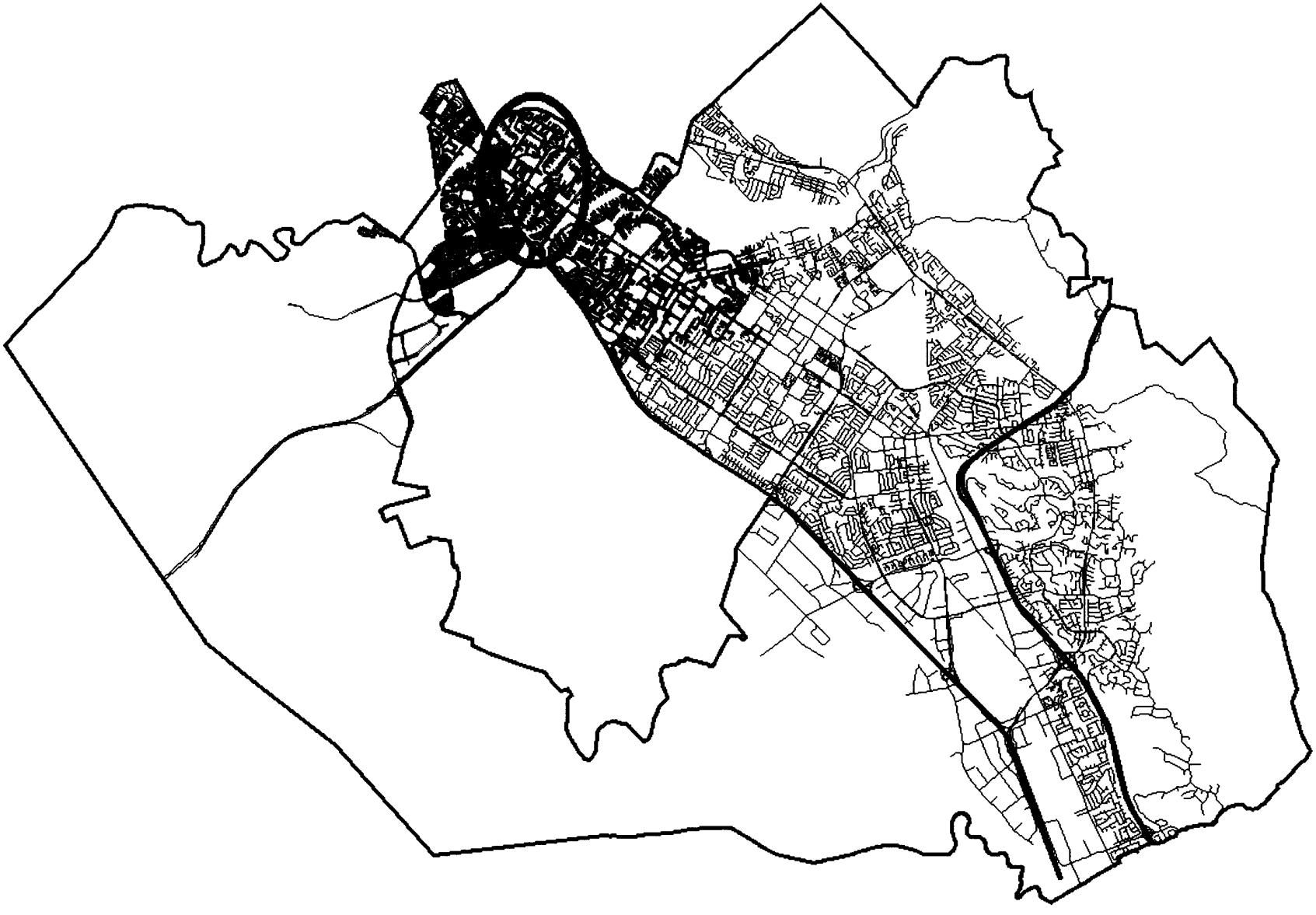
M-6	All Calls



M-8	All Fire Calls



M-9	All Fire Calls Hot Spots



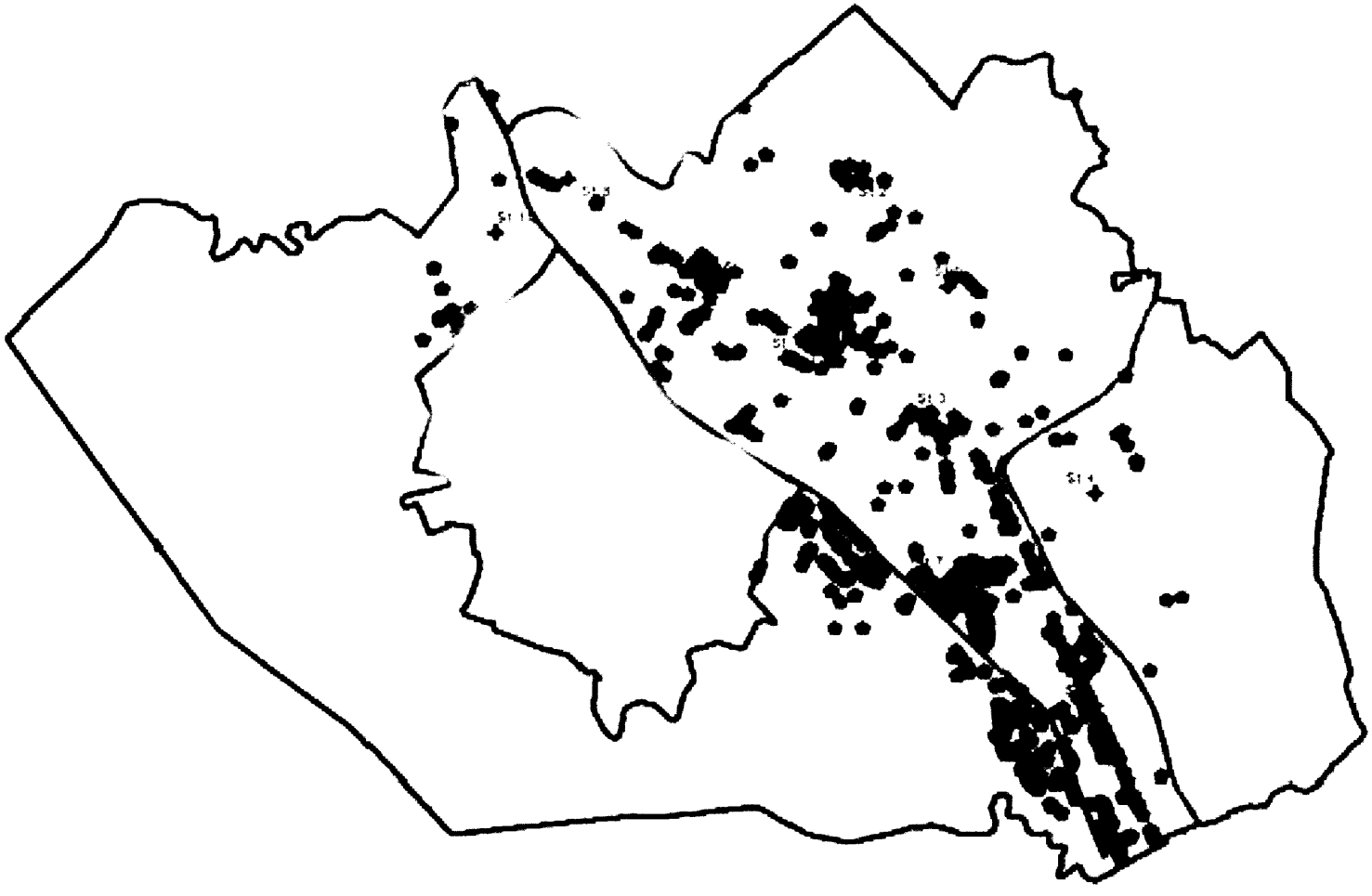
M-10	District 8 & 10, 4-Minute Drive Time Overlap

M-11	T1 & T7, 8 Minute Overlap Coverage

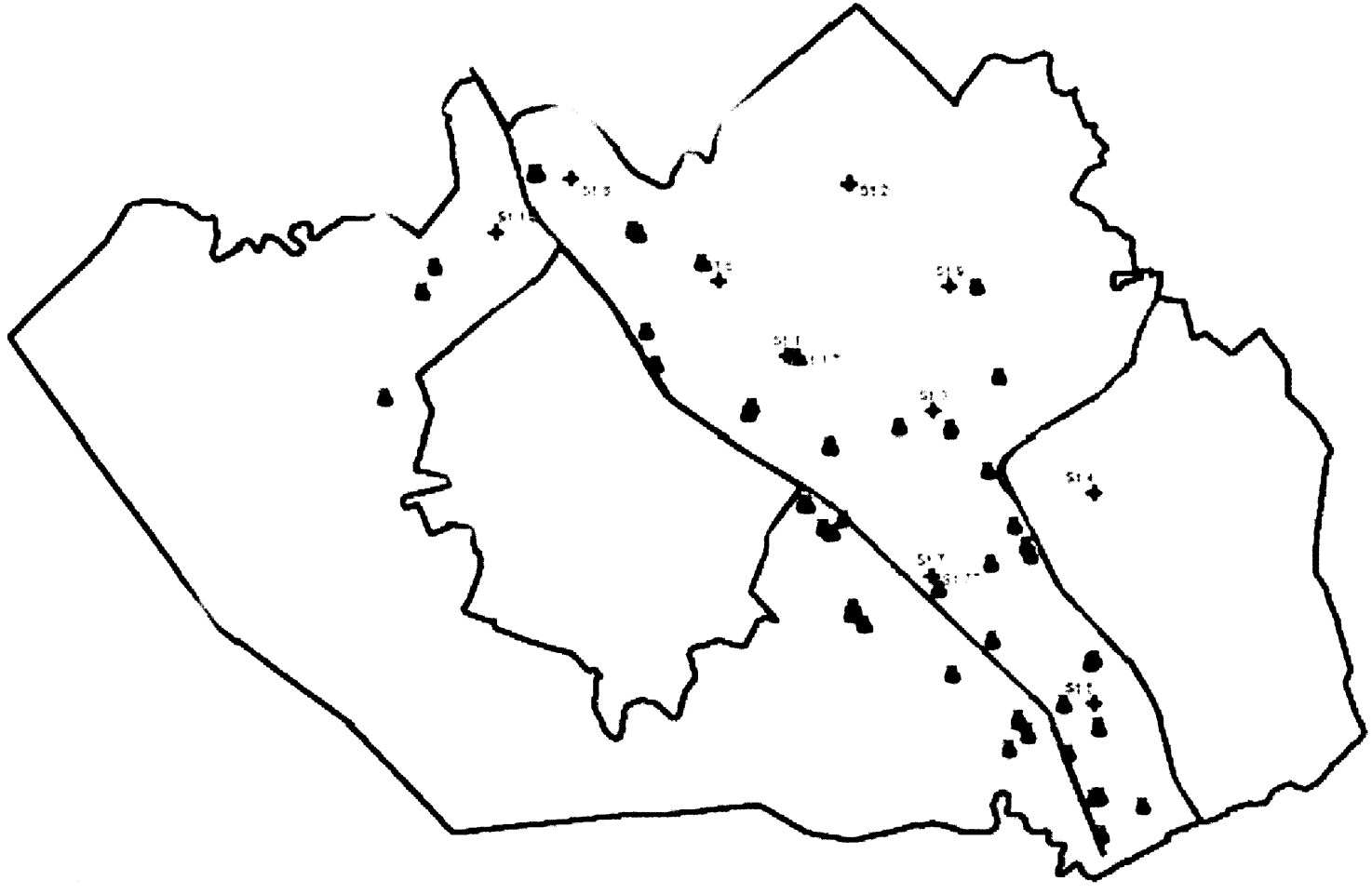
M-12	Truck 1 & 7, Beyond 8-Minute Drive Time

M-13	4 Minute Drive Time by Fire Districts

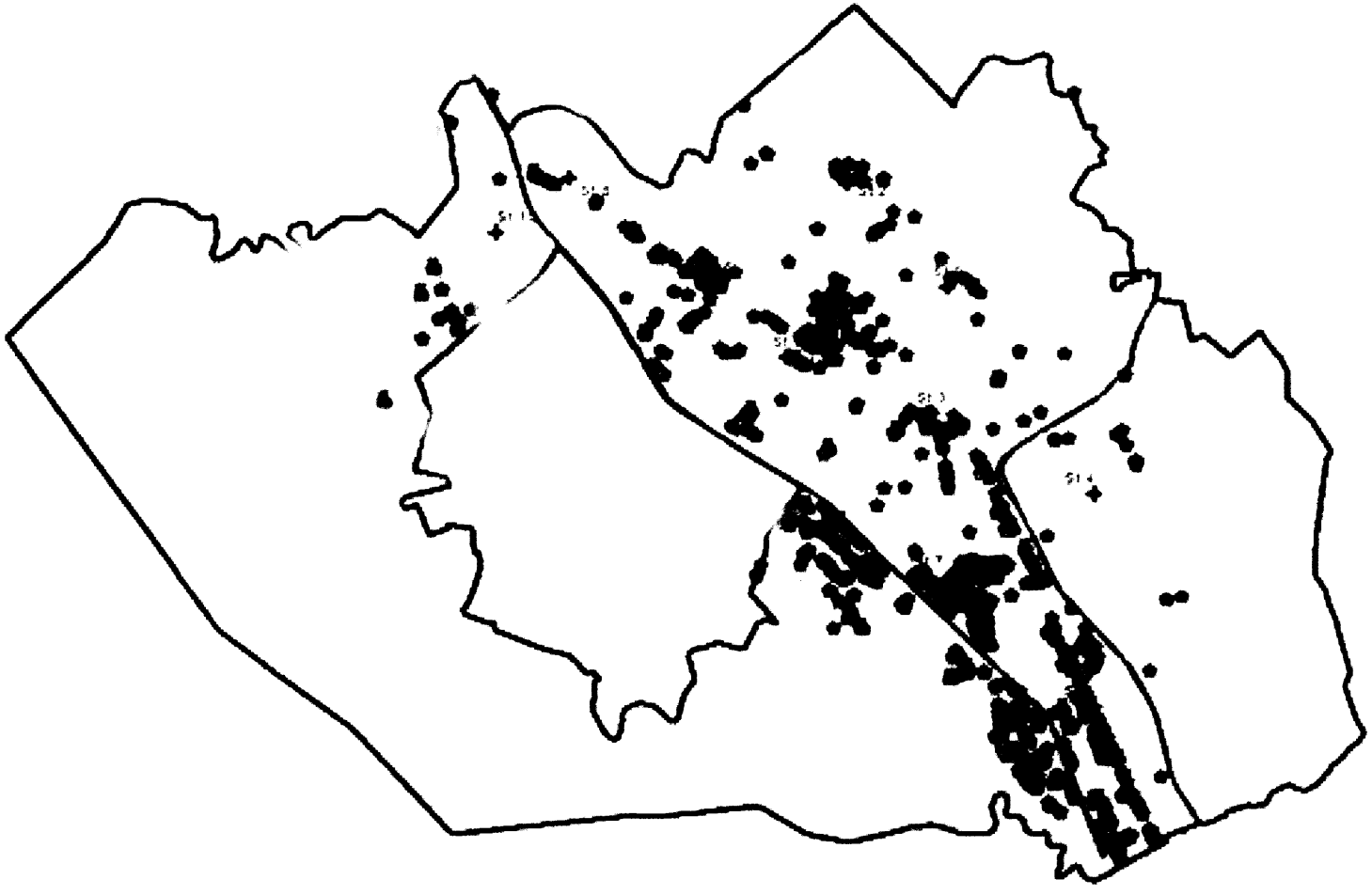
M-14	4- Minute Drive Time with Beyond Coverage in Red



M-15	High Risk Occupancies



M-16	High Value Occupancies



M-17	High Risk & High Value Occupancies

M-18	Hazmat Facilities

APPENDIX B

ANALYSIS OF ALTERNATIVES

Resource alternatives and options to the proposed recommendations were considered and analyzed during the development of this Standards of Coverage. Each of the alternatives is listed here with a brief discussion of their anticipated outcomes if implemented, respective limitations and financial considerations. All alternatives assume the relocation of Stations 6 (Centerville) and 8 (North Fremont) and the return of Station 11 based upon development activity within Baylands Industrial District. Additionally, options in need of further analysis are included that if there is interest in their consideration, should receive more study.

Analysis of Alternatives

1. Add a 4th person to each of the two Truck Companies. No additional companies.

Benefits: Increases staffing at multiple company incidents, supports concentration criteria in limited areas, increases task capacity of truck companies, increases on-duty staffing, limits new costs.

Disadvantages: Less ability to support high incident intensity in center of City, no increase in truck availability, if truck relocated from Station 1, remaining company availability will be unacceptable as capacity for a single company will be exceed, If Truck 1 is not relocated, truck deficiencies in Districts 2 (Niles), 8 (North Fremont), and 10 (Ardenwood), no additional FRALs reimbursement, does not support distribution criteria.

2. Add a 4th person each to Engine 2 (3842), Niles, Engine 5 (3845), Warm Springs and both Truck Companies. No additional companies.

Benefits: Increases staffing at multiple company incidents, increases task capacity of truck companies, more quickly addresses 2 in, 2 out requirement in fringe areas of City, supports concentration criteria in limited areas, increases on-duty staffing.

Disadvantages: Does not support distribution criteria or improve response time performance, does not improve availability of truck companies, higher cost than recommended course of action, does not support relocation of Truck 1, does not assist in addressing high intensity call volume concentrated in the core of the City,

3. Add a three-person Rescue Company at Fire Station 1 and a 4th person each to Engine 2 (3842) Niles and Engine 5 (3845) Warm springs.

Benefits: Recommendation will support the relocation of Truck 1 to Station 6 and address the concentration of incidents in the central corridor of the City generally and specifically within District 1, supports concentration criteria, increases truck company availability, more quickly addresses 2 in, 2 out requirement in fringe areas of City, increases on-duty staffing.

Disadvantages: Higher cost than initial recommendation, more evaluation and monitoring is needed to determine value of additional cost, currently there is no information available to evaluate how much of an improvement in property conservation can be realized if fringe company staffing is increased. Additional studies should be initiated.

4. Add a 4th person to Engine 1 (3841), Engine 3 (3843) and Engine 6 (3846). No additional companies.

Benefits: Increases staffing at multiple company incidents in central areas of City, adds staffing where the highest incidence of call volume occurs, increases task capacity of three companies, shortens the time to drug therapy during critical medical incidents. Limits new costs.

Disadvantages: Limits the capacity of adding additional personnel, not as flexible as adding an independent company, no increase in truck availability, no additional FRALs reimbursement, does not support distribution criteria, does not allow relocation of Truck 1 (3871) and therefore does nothing to address truck coverage deficiencies in Districts 2 (Niles), 8 (North Fremont), or 10 (Ardenwood), does not increase truck company capacity, does not assist in improving reliability concerns of busy companies or improvements to response time

5. Evaluate opportunities for increased automatic or mutual aid opportunities with neighboring agencies.

Benefits: Provides potential to reduce response times in fringe areas of community near adjacent agencies' resources, provides potential to improve concentration of resources in fringe areas of community near adjacent agencies' resources. Minimizes new costs.

Disadvantages: Does not improve response performance in high intensity districts, does not address truck company deficiencies, does not address concentration deficiencies in center of City.

6. Add 4th person to each to Engine 1 (3841 Central), Engine 3 (3843 Irvington), Engine 6 (3846 Centerville), Truck 1 (3871), Truck 7 (3877 Auto Mall/Grimmer), no new companies.

Benefits: Increases on-duty staffing of emergency personnel by 12%, reduces the number of companies needed to mitigate multi-company incidents, supports concentration of effective response force, adds personnel in critical high intensity call volume areas, more effectively supports 2 in, 2 out regulation, increases capacity and capabilities of five companies, increases number of personnel available for disasters and significant emergencies.

Disadvantages: Does not increase truck availability, does not improve truck coverage, does not improve response time performance, adds additional cost

7. Add a 4th person to all in-service companies, no additional companies

Benefits: Reduces the number of companies needed to mitigate multi-company incidents, supports concentration of effective response force, adds personnel in critical high intensity call volume areas, more effectively supports 2 in 2 out requirement, increases emergency response personnel for large scale incidents and disasters, increases capacity of all in-service companies

Disadvantages: Many of the outcomes anticipated by the implementation of this alternative can be accomplished with fewer resources, high cost of implementation, does not support distribution criteria, does not support relocation of Truck 1 or improve truck company coverage in Districts 2, 8 or 10.

Additional options for future consideration (Additional evaluation and analysis will be necessary to determine suitability of these options)

1. Evaluate Quint Aerial Ladder apparatus instead of Tractor-drawn Truck Companies.

    a. Determine Quint staffing to meet concentration criterion based upon whether one Quint replaces a Truck and Engine in a single station or one Truck in a station. If one Quint replaces two former companies, consider adding staff to the Quint, adjacent companies or within battalion.

2. Explore more formal cooperative regional opportunities with one or more neighboring fire agencies including shared services, dedicated automatic response areas, functional consolidations, resource sharing and partnerships.